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COMMITTEE ON FOOD PRESERVATIVES.

REPORT

OF THE

DEPARTMENTAL COMMITTEE

APPOINTED TO INQUIRE INTO THE

USE OF PRESERVATIVES AND COLOURING MATTERS

IN THE

PRESERVATION AND COLOURING OF FOOD,

TOGETHER WITH

MINUTES OF EVIDENCE, APPENDICES, AND INDEX.

Presented to both Houses of Parliament by Command of His Majesty.

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CONTENTS.

	PAGE.
WARRANT OF APPOINTMENT	iii
REPORT	v–xxxii
LIST OF WITNESSES	xxxiii
INDEX TO WITNESSES	xxxv
EVIDENCE	1–267
APPENDICES:	
INDEX TO APPENDICES	268
APPENDICES I.—XXXVI.	269–414
PRÉCIS OF EVIDENCE	415
INDEX TO EVIDENCE	449

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MINUTE OF APPOINTMENT.

I hereby appoint :—

Right Hon. Sir Herbert Eustace Maxwell, Bart., M.P.

Professor Thomas Edward Thorpe, Vice President of the Royal Society.

Herbert Timbrell Bulstrode, Esq., M.D.

Francis Whittaker Tunnicliffe, Esq., M.D.

To be a Committee to inquire into the use of preservatives and colouring matters in the preservation and colouring of food and to report :—

(1) Whether the use of such materials or any of them, for the preservation and colouring of food, in certain quantities, is injurious to health, and if so, in what proportions does their use become injurious.

(2) To what extent, and in what amounts, are they so used at the present time.

And I hereby appoint the Right Hon. Sir Herbert Eustace Maxwell to be Chairman, and Charles Jonathan Huddart, Esq., to be Secretary of the said Committee.

(Signed) Henry Chaplin,
President of the Local Goverment Board.

Whitehall,
10th July, 1899

REPORT.

To the Right Honourable
the President of the Local Government Board.

Sir,

THE Committee appointed in 1899 to "inquire into the use of preservatives and colouring matters in the preservation and colouring of food, and to report (1) whether the use of such materials, or any of them, for the preservation and colouring of food, in certain quantities, is injurious to health, and, if so, in what proportions does their use become injurious; (2) to what extent, and in what amounts, are they so used at the present time," have the honour to report as follows :—

1. We have held meetings to receive evidence on 26 days, during which we have examined 78 witnesses.

2. We have received from the Foreign Office information as to the law and practice in regard to preservatives and colouring matter in food which prevail in certain foreign countries (Appendix I.), and similar information from the Colonial Office in regard to the law and practice in the British Colonies (Appendix II.).

3. Having in view the special bearing of the subject of our Inquiry upon the dairy industry we appointed a Sub-Committee, consisting of Dr. Bulstrode and Mr. Huddart (the Secretary), to visit Denmark, Amsterdam, and Hamburg. The reports of this Sub-Committee will be found as Appendix III. The same Sub-Committee, with the addition of Professor Tunnicliffe, afterwards visited Ireland, and their report on the practices found in force in that country is given in Appendix IV.

4. Dr. Bulstrode and Professor Tunnicliffe visited two factories in this country, where artificial colouring is used in the preparation of preserved vegetables. The managers not only gave information as to the method of manufacture, but were good enough to allow independent experiments to be made in order to ascertain the relative effects of various amounts of copper sulphate upon the intensity and permanence of the colour produced.

Professor Tunnicliffe also submitted samples of preserved peas bought in open market on the Continent for analysis. The results are given in Appendix V.

5. In Appendix VI. are given the results of a series of experiments on the effect of preservatives upon sucking pigs, as conducted by Mr. A. D. Hall (Principal of the South Eastern Agricultural College, Wye), and Mr. H. S. Hammond, in collaboration with Professor Tunnicliffe.

6. In addition to the results of experiments and observations conducted at the instance of your Committee, there have been placed at our disposal the results obtained from independent observations conducted by Professor Tunnicliffe and Dr. Otto Rosenheim upon the effect of certain preservatives upon the metabolism of children, also further results by the same observers with regard to the digestibility in the human subject of the compound of copper which gives to preserved pease their green colour. These papers form the substance of Appendix VII. (*a.*) (*b.*) (*c.*)

Dr. Otto Rosenheim was deputed to attend for the Committee the International Congress of Medicine which was held at Paris on August 2nd and 9th, 1900, and to report to the Committee relative to the papers upon Preservatives and Colouring Matters read at the Congress, and upon the discussion which followed.

7. A series of tables prepared at the Government Laboratory by direction of Professor Thorpe is given as Appendix VIII. These tables give the results of a large number of analyses, made specially for the purposes of the Committee, of samples of food and drink in relation to contained preservatives and colouring matters.

De Hailes, 3903–13.
Gibson, 6331–42.
Lough, 6637–40.

8. In consequence of the complaints of several witnesses as to the defective provision made by railway companies for the milk and butter traffic, we caused a letter to be addressed to nine companies having termini in London, requesting information in reply to specific questions upon their arrangements in that respect. In every case we received replies upon all the points, which will be found in Appendix IX.

9. Our Inquiry has been greatly facilitated by the readiness shown by tradesmen and trading companies to supply information and to send witnesses. In a single instance only—that of the Welford Dairy Company—was the request of the Committee for evidence met with a refusal. While some of the witnesses examined held strong views upon one side or the other, and others were concerned in defending particular interests which appeared to them to be threatened by the appointment of your Committee, there seemed to be a very general desire to get at the truth in the matter, and a conviction that it was very desirable to put an end, if possible, to the present state of uncertainty in regard both to the legality of modern preservatives and of artificial colouring of food, and their physiological effect upon the consumer.

10. With the object of securing thoroughly representative evidence within our terms of Reference, invitations in which these terms were detailed were sent to a variety of individuals and communities. A detailed list of the witnesses is given at page xxxiii, and the following classification of the acceptances will serve to demonstrate the ground covered. In several cases trading companies and societies were represented by professional experts.

	No. of Witnesses.
Agricultural Societies	4
Bacon Industry	2
Butter Industry	7
Dairy Industry	6
Chambers of Commerce	4
Grocers' Federation and Provision Traders	6
Jam and Confectionery Industry	2
Wine, Beer, and Cider Merchants	4
Danish and New Zealand Governments	2
Analysts and Chemists	12
Bacteriologists	2
Physiologists	3
Medical Officers of Health	9
Physicians, Surgeons, and Pathologists	4
London and Provincial Hospitals	4
British Medical Association	2
The "Lancet"	1
Royal College of Physicians	2
Royal College of Surgeons	2
	78

11. In answer to an invitation to send witnesses, the Brewers Association referred us to their evidence before the Select Committee on Beer Materials, and in view of the recent date of that inquiry we did not press for further evidence from the brewing industry.

12. Our Inquiry naturally divided itself into two parts [1] Preservatives, and [2] Colouring Matters.

I.—PRESERVATIVES.

13. That articles of food can be preserved—that is, so treated that their decomposition can be prevented, or at least retarded—by the use of a number of substances, such as oils, spirits of wine, vinegar, salt, sugar, etc., has been known from very early times, but until comparatively recently the preservative agents used were, for the most part, of natural origin and of the nature of foods themselves. It was surmised that the changes to which food is liable were, broadly speaking, akin in character to fermentation, and hence when the real nature of fermentation came to be known, and when it was ascertained how the action of "ferments" could be controlled or even inhibited by cold, heat, sterilisation, or by the action of chemical substances, the art of preserving food was placed upon an intelligible basis.

Vasey, Appendix X.

14. Concurrently with the development of our knowledge of the part played by "ferments"—organised and unorganised—in effecting putrefactive or fermentative changes, the extraordinarily rapid progress of chemistry, and especially of organic chemistry, during the last half century, has made known the existence of many new substances capable of either wholly preventing or greatly retarding such changes. These artificial substances are classed generically as "antiseptics," and it was but natural that attempts should be made to use them in the conservation of food. Their application was, however, restricted by the circumstances that many of them were actively poisonous, or rendered food unpalatable, or that they were too costly for use on a commercial scale.

15. From the evidence brought before the Committee it would appear that at the present time the only artificial or chemical antiseptic agents other than those alluded to above (Paragraph 13) employed, or said to be employed, in the preservation of food are—

Boric or boracic acid and borates; so called "boron preservatives,"
Sulphurous acid and sulphites,
Fluorides,
Salicylic acid,
Benzoic acid or benzoates,
Formalin or formaldehyde.

16. As regards fluorides, benzoic acid, and the benzoates it may be said at once that, if employed at all, their use must be extremely limited. Except Messrs. Boseley, Cassal, Droop Richmond, and Vasey, none of the witnesses who appeared before the Committee were able to speak of their use from personal knowledge, nor were these substances detected in any of the samples of food or drink examined in the Government Laboratory. Mr. Leonard Boseley, analyst to Messrs. Keiller and Son, Limited, stated in evidence that he believed that a firm in London were trying to get benzoate of soda taken up as a preservative for jams; but it is not being used, at any rate at present, in any great quantity.

Fluorides, Benzoic acid and benzoates.
Boseley, 1046.
Vasey, 2043, 2046.
Cassal, 3816.
Boseley, 968.

17. The boron preservatives are preparations of borax and boracic acid (with or without admixture of other preservative ingredients, such as salt, saltpetre, sugar, carbonate of soda, etc.), and are generally sold in the form of a white powder (sometimes, however, coloured with a coal-tar dye) under a great variety of fanciful names, which as a rule afford no clue to their real nature. The composition of a number of these boron preservatives, as ascertained in the Government Laboratory, is given in Appendix VIII. (Table H.). They are used largely for dairy produce (especially in milk, butter, and cream), for margarine, ham, bacon, sausages, and preserved meat foods generally, and to a much smaller extent in beverages.

Boron Preservatives.

Salicylic Acid.

18. Salicylic acid (often used in the form of salicylate of soda) comes next in importance as regards the extent to which it is used as a preservative. It is employed chiefly in beverages (wines, beer, cider, and temperance drinks), and in foods derived from fruit, as jams and jellies, in order to prevent alcoholic and other fermentative changes.

Formalin.

19. Formalin, which is of comparatively recent introduction, consists of a 40 per cent. solution of formaldehyde—a gas at ordinary temperatures—in water. The solution is diluted to various strengths and sold as a preservative for milk chiefly, and to a less extent for other foods. In its concentrated form the solution of formaldehyde is a very potent and even poisonous substance. Even when comparatively dilute it has a remarkable effect upon animal tissue, and quickly coagulates casein, albumen, and other proteid bodies.

Sulphites

20. Sulphites (the active principle of which is sulphurous acid) are used for very much the same purposes as salicylic acid, especially by brewers. They are also employed by butchers and to a less extent by game and poultry dealers.

21. The evidence tendered to the Committee on the question raised by the second part of the reference, viz., to what extent and amount these preservatives are used at the present time, consisted partly in the statements of traders and medical officers of health, and partly in analytical matter received from public and private analysts. There is also the large body of analytical evidence furnished by the Government Laboratory, a summary of which is embodied in this report.

22. Mr. T. Carrington Smith, representing the Central Chamber of Agriculture, gave, as the result of an enquiry amongst a large number of farmers and dairymen, a list of the preservatives used by these traders. (Appendix XI., Table A.) Out of 110 replies received, both from London and the provinces, sixty-five admitted the use of preservatives. Twenty-two different brands of preservatives are mentioned, most of which are included amongst those examined in the Government Laboratory. In at least thirteen of these the basis was boric acid; two were formalin preservatives; the remainder being salt and saltpetre, and a few of unknown composition.

Sandes, 79.
Gibson, 6328.
Dale, 250.
Shanahan, 356.
Hudson, 497.
Lovell, 719, 721, 728.

23. Captain Sandes, County Kerry, said it was the practice in his creamery to add 1 lb. of preservative to 112 lbs. of butter, in conformity with the recommendation of Mr. Robert Gibson, Salesmaster of the Public Creamery Market, Limerick, who stated that was what he recommended all makers to do, and what he did in the case of butter he made up himself. Alderman Dale, who represented the Cork Butter Exporters' Association, stated that he added about three-quarters per cent. of preservative all the year round. Mr. Henry Shanahan, the Managing Director of the Cork and Kerry Creamery Company, found it desirable to restrict the quantity to one-half per cent., "for fear of any trouble." Mr. James Hudson, of Hudson Brothers, Limited, also thought that one-half per cent. was quite sufficient, and stated that his firm objected to more being used in the produce consigned to them. Mr. Lovell, of Lovell and Christmas, Limited, also informed the Committee that his firm strongly impressed upon all their consignors that they should not use over one-half per cent. He said, "We advise all our people in Australia, New Zealand, the Argentine, and Ireland, wherever we get butter from, to use one-half per cent. of the preservative—that is, half a pound to 100lbs. or hundredweight." He also stated that his firm had stopped pasteurisation wherever they had any control of the matter, as in his opinion the process impaired the flavour of the butter. His firm had long imported butter from Normandy; this used to be salted, but was now treated with boron preservatives. In reference to questions as to whether Denmark, Sweden and Norway prohibited the use of preservatives, he stated that he could tell the Committee "something about other countries who have laws against the use of preservatives in butter, but

yet do sanction it for all that is to be imported" [*i.e.*, exported]. Asked whether the French are very stringent on the matter of preservatives, he replied that he did not want to tell the Committee anything that was detrimental to his business, but added that "the French Government at one time absolutely prohibited the use of preservatives for all butter manufactured in their country, but when it was laid before the Government there by those who were interested in the dairy industry that it would be a fatal blow to the commerce of the country—well, I may finish that by saying to you that our butter that comes from Normandy contains a half per cent. of preservative."

24. Mr. Trengrouse, who represented the London Chamber of Commerce, also stated that the instructions of his firm to factories were to use 0·5 per cent. Mr. Clement, who appeared for the Scottish Wholesale Provision Merchants' Association, stated that all the butter from the Australian colonies of which he had any experience, contained boric acid—on the average he thought about 0·5 per cent. He informed the Committee that his firm, who were the agents for the Agricultural Department of the Canadian Government, had strongly advised that Government to issue recommendations to the factory men to use boracic acid, which apparently had not hitherto been generally employed. Trengrouse, 646. Clement, 1518.

25. Mr. McCracken, the Managing Director of the United Creameries, Dunragit, said that his company added boric preservatives to all their products—milk, margarine, and cream, except fresh butter. They stipulate, however, that it shall not be introduced by farmers into the milk supplied to them. In the case of milk they add it to the extent of from half an ounce to one ounce to a sixteen gallon can. McCracken, 2852.

26. Mr. Dunn, the Chairman of the Cork Butter Market Trustees, said that the butter-makers who sent butter to the Cork market, as a rule, did not put preservatives in their butter, but that a preservative was very largely used in butter factories and also in the creameries. One of the creameries in Cork pasteurises the milk and does not use a preservative. Dunn, 3013.

27. The Committee received a considerable amount of evidence from importers of bacon as to the use of boracic acid and borax in packing American and Canadian produce. The general opinion was that boric preservatives were not used in curing, but only in protecting the bacon from taint and fly-blow in course of transit, and that whatever boric acid was found in the body of the meat—and it was assumed it was in all cases very small—was due simply to the gradual interpenetration of boracic acid from the dry powder with which the sides were dusted when in the "green" state. It was asserted that the greater quantity of the adherent powder was brushed and washed away, on arrival, preparatory to smoking. On the other hand, many analysts stated that the amount of boric acid present was frequently considerable even in the body of the meat, and evidence was given that boric preservatives are occasionally used in the "pickle" injected into the carcase.*

28. The samples of food and drink (Appendix VIII.) examined for preservatives by the analysts of the Government Laboratory were, partly, imported products, and, partly, products of home manufacture. They were procured at the ports of entry, from the warehouses of importers, or were purchased from retailers by direction of the sanitary authorities of various cities and towns throughout the United Kingdom.

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* In a recent number of "Ice and Cold Storage," Mr. L. M. Douglas states that the pickle injected into the carcase contains 5 lbs. of "antiseptic" with 55 lbs. of salt, 5 lbs. of saltpetre, and (in winter only) 5 lbs. of cane sugar. These ingredients are dissolved in water and made up to 20 gallons. In a letter addressed to Professor Thorpe he states that the antiseptic, the use of which he considers desirable, consists of a readily soluble mixture of boric acid and borax.

29. The Local Authorities of the following places responded to the invitation of the Committee to send samples of food and drink to the Government Laboratory for the purposes of this inquiry :—

- London—
  - Bethnal Green,
  - Camberwell,
  - Mile End,
  - St. George-in-the-East,
  - Shoreditch,
  - Hampstead,
  - Islington,
  - Kensington,
  - Lambeth,
  - Plumstead,
  - Wandsworth,
- Belfast,
- Birmingham,
- Bristol,
- Cardiff,
- Cork,
- Dublin,
- Edinburgh,
- Glasgow,
- Hull,
- Leeds,
- Leicester,
- Liverpool,
- Manchester,
- Newcastle,
- Plymouth,
- Preston,
- Sheffield.

30. Table B in Appendix VIII. contains a list of firms in London, Liverpool, Manchester, Glasgow, Edinburgh, and Leith, who, on the invitation of the Committee, sent representative samples of imported products to the Government Laboratory. A number of samples of imported products were obtained from wholesale houses in the City of London, through the instrumentality of the late Dr. Sedgwick Saunders, to whom the Committee are much indebted for the readiness with which he sought to further the objects of their inquiry.

31. Various beverages sent to the Government Laboratory in connection with the spirit duty were examined also for preservatives. The Excise officers in London and in various parts of the United Kingdom also assisted by sending samples of certain specified temperance beverages, such as fruit wines (raspberry, etc.), ginger wines, lemon squash, taken from the larger traders. Some of these were found invariably to make use of preservatives, salicylic acid being the one most generally used.

31A. The following table gives a list of the foods and drink examined, and shows the number containing preservatives, together with the nature of the preservative :—

Summary of Samples of Food (both Home and Imported Produce) and the Preservatives found therein (examined in the Government Laboratory).

No.	Description.	Total samples.	Preservatives.				Total containing two Preservatives.	Total containing Preservatives.	Percentage preservatised.
			Boric acid.	Salicylic acid.	Formalin.	Sulphites.			
1	Milk	296	48	—	7	—	1	54	18·2
2	Cream	290	223	2	6	—	5	226	77·9
3	Butter	364	208	—	—	—	—	208	57·1
4	Margarine	133	99	—	—	—	—	99	74·4
5	Cheese	196	—	—	—	—	—	—	—
6	Condensed milk	86	—	—	—	—	—	—	—
7	Bacon	210	148	—	—	—	—	148	70·5
8	Ham	185	153	—	—	—	—	153	82·7
9	Sausages	226	150	—	—	—	—	150	66·4
10	Potted meats	165	87	1	—	—	—	88	53·3
11	Preserved meats	135	16	—	—	—	—	16	11·9
12	Brawn	56	32	—	—	—	—	32	57·1
13	Fresh fish	43	—	—	2	—	—	2	4·6
14	Preserved fish	44	—	—	—	—	—	—	—
15	Meat jellies	25	1	—	—	—	—	1	4·0
16	Fruit jellies	28	—	2	—	—	—	2	7·1
17	Pork pies	48	34	—	—	—	—	34	70·8
18	Lard	52	—	—	—	—	—	—	—
19	Jam	150	3	52	—	18	7	66	44·0
20	Preserved fruits	48	—	—	—	2	—	2	4·2
21	Fruit pulp	10	—	—	—	—	—	—	—
22	Preserved vegetables	49	—	—	—	—	—	—	—
23	Lime and lemon juice	78	3	57	—	26	17	69	88·5
24	Cordials	24	—	14	—	8	5	17	70·8
25	Fruit syrups	23	—	14	—	3	2	15	65·2
26	Temperance drinks	769	29	151	3	52	34	201	26·1
27	Imported beers	100	—	19	—	20	—	39	39·0
28	Wines and beers	32	1	6	—	3	—	10	31·2
29	Vinegar	77	—	1	2	10	—	13	16·9
30	Meat extracts	50	4	—	—	—	—	4	8·0
31	Sauces and ketchups	10	—	1	—	1	—	2	20·0
32	Soups	49	8	—	—	—	—	8	16·3
33	Sugars	149	—	—	—	—	—	—	—
34	Spices	22	—	—	—	—	—	—	—
35	Miscellaneous (Invalid foods, cocoa, gelatine, etc.)	29	—	—	—	—	—	—	—
	TOTALS	4,251	1,247	320	20	143	71	1,659	39·0

It will be seen from the above table that of the 4,251 articles of food and drink examined at the Government Laboratory, 1,659 samples, or 39 per cent., contained preservatives. Of the 1,659 "preserved" samples, 1,247 contained boron preservatives, 320 contained salicylic acid, 20 contained formalin, and 143 contained sulphites. Seventy-one of the samples contained more than one preservative.

32. Of the 4,251 samples examined, 2,216 were received from the Local Authorities of the various metropolitan districts and provincial towns above

named. The result of the examination of these samples is seen in the following table :—

TABLE showing the Number of Samples received from the Local Authorities and other sources in various Provincial Towns and Metropolitan Districts, and examined in the Government Laboratory.

Place.	Total number of samples.	Total containing Preservatives.	Percentage preservatised.
Belfast	46	14	30·4
Birmingham	89	43	48·3
Bristol	61	26	42·6
Cardiff	60	31	51·6
Cork	57	26	45·6
Dublin	122	52	42·6
Edinburgh	63	24	38·0
Glasgow	66	30	45·4
Hull	56	29	51·7
Leeds	81	41	50·6
Leicester	30	21	70·0
Liverpool	69	31	44·9
Manchester	89	38	42·6
Newcastle	85	40	47·0
Plymouth	74	33	44·5
Preston	68	37	54·4
Sheffield	95	52	54·7
Total—Provinces	1,211	568	46·9
London :—			
Bethnal Green	69	37	53·6
Camberwell	73	37	50·6
Hampstead	78	27	34·6
Islington	83	36	48·3
Kensington	83	39	46·1
Lambeth	82	41	50·0
Mile End	218	85	38·9
Plumstead	80	31	38·7
St. George-in-the-East	75	26	34·6
Shoreditch	76	28	36·8
Wandsworth	88	42	47·7
Total—London	1,005	429	42·7
Total—United Kingdom	2,216	997	45·0

Comparison of various towns and London districts.

33. The percentage of foods found "preserved" in the different towns in the provinces was found to vary between 30·4 per cent. (in Belfast), and 54·7 per cent. (in Sheffield). An exceptional case is Leicester, in which the proportion of foods preservatised reached 70 per cent.*

The percentages in the London districts are of the same order, ranging from 34·6 both in Hampstead and St. George-in-the-East, to 53·6 in Bethnal Green.

The average for the Provinces is 46·9, for the Metropolis 42·7, and for the United Kingdom 45·0 per cent. of the samples taken by the Local Authorities.

Comparison of poorer and wealthier districts of London.

A comparison of the percentages of preservatised foods in the poorer districts and the wealthier districts of the Metropolis respectively shows that they are practically identical, being 42·9 per cent. in the former and 43·4 per cent. in the latter.

---

* After the first twenty samples the Town Council of Leicester ceased to assist, and made no response to subsequent communications addressed to them on the subject.

34. About 180 samples of milk, butter, and cream were sent by a number of the metropolitan hospitals, including those for children, and also by the Pendlebury Children's Hospital near Manchester, but in none of the samples of milk, with the exception of those from St. George's, London, was any preservative found. On the other hand, nearly every sample of butter, with the exception of those from the Pendlebury Children's Hospital, contained boric preservative, as did the samples of cream received from St. George's and St. Mary's Hospitals. The maximum, minimum, and average amount of the preservatives present in the several instances are shown in Appendix VIII., Tables E and F. Hospital samples.

35. Preservatives are extensively used in certain foods imported into the United Kingdom from the Colonies and foreign countries, especially in butter from Australia, in ham and bacon from Canada, and in butter and margarine from France, Holland, and Belgium. Preservatives in imported foods.

36. No comparison can fairly be made as to the extent to which preservatives are used in home and imported foods respectively, since a large proportion of the food samples received from the various local authorities at home, must from their nature have been imported originally, but we have no specific information on this point. In the case of hams and bacon, however, it can be affirmed with certainty that the imported goods are preservatised to a much greater extent than the home produce. Moreover the analysis does not bear out the contention of the importers that practically the whole of the boric preservative used for packing the hams and bacon in transit from Canada and the United States is removed by the washing and scrubbing process which they undergo on this side, and that therefore no boric acid is found in the meat. Comparison between imported foods and home products.

37. Of the temperance beverages received from all parts of the United Kingdom, 83·5 per cent. of those sold as temperance "wines" and cordials contained preservatives, chiefly salicylic acid, and to a less extent sulphites, whereas these substances were present in only 19 per cent. of the so-called herb-beers. (Appendix VIII., Table G.) Temperance beverages.

The large extent to which preservatives are found in the temperance wines and cordials as compared with the herb-beers and similar temperance drinks, arises from the fact that the former are generally speaking flavoured syrups in which it is desirable that fermentation should not take place, and which, moreover, may have to be kept for an indefinite period before going into consumption. The herb-beers, on the other hand, generally contain yeast in order to set up a certain degree of fermentation resulting in the production of carbonic acid gas and alcohol, both of which have a preservative action. The extent to which fermentation may proceed is, however, restricted by the fact that the legal amount of alcohol which such beverages may contain is limited to 2 per cent. of proof spirit, though occasionally the amount is found to exceed this, and to rise in some cases as high as 10 per cent.

The restriction would in itself tend to encourage the use of preservatives in this class of beverages were it not that they are usually intended for immediate consumption. (Appendix VIII., Table G.)

38. The frequency with which perishable articles such as milk, cream, and butter are mixed with preservatives may be expected to depend upon climatic conditions and also upon the conditions under which such articles may have to be kept pending their sale. Thus in the case of milk, preservatives are, as a rule, more freely used in summer than in winter. Dr. Hill, of Birmingham, found 5 per cent. of the samples of milk examined by him during the winter half year contained preservatives, as compared with 18 per cent. of the summer samples. It was found, too, that samples of milk taken on Sunday in London, especially during hot weather, more frequently contained preservatives than those taken on week-days, approximately in the relation of 2 to 1. Effect of Season on the use of Preservatives. Hill, 2334.

Hehner 5582–84. 39. Samples of cream bought from dairies are less frequently admixed with boron preservative than in the case of samples obtained from grocers. The greater number of the so-called potted creams contain it at all seasons of the year. (Appendix VIII., Table D.)

40. As regards butter the results are complicated by the importation of large quantities of colonial produce, especially from Australia, at certain seasons of the year. Thus, out of 1,393 samples of butter sent by the Customs and examined in the Government Laboratory during the year ending 31st March, 1900, only 22 per cent. of those received during the months from April to September inclusive contained preservatives, as against 34 per cent. of those examined during the winter half of the year—October to March inclusive. These numbers are almost identical with those of Dr. Hill, who found that 31 per cent. of his winter samples of butter contained preservative, whereas the proportion of the summer samples was only 23 per cent. Hill, 2344.

41. With regard to the amounts of the several preservatives which are to be found in the various articles of food, the qualitative examination was so arranged as to give a comparative idea of the quantity present, and accurate quantitative estimations were then made on representative samples. The results are set out in Appendix VIII., Table J. It appears that the boric acid in the milks examined varied from 1·3 to 9·1 grains per pint; in cream, from 10 to 57 grains per pint; in sausages, potted meats, and brawn, from 15 to 66 grains per lb.; in butter, from 18 to 65 grains per lb.; in margarine, from 7 to 73 grains per lb.; in bacon, from 8·6 to 46 grains per lb. The amount of salicylic acid in jams varied from 1·7 to 8·5 grains per lb.; in temperance drinks and cordials, from 1·5 to 19 grains per pint; in herb-beers and similar beverages, from 0·5 to 8·1 grains per pint; and in imported beers, from 1·3 to 3·4 grains per pint. Sulphites were found to be contained in lime juice, ginger wine, lemon syrup, raspberry and peppermint cordial, in amount (estimated as sulphur dioxide) varying from 0·1 grain to 4·5 grains per pint; and in imported beers, from 0·2 to 1·6 grains per pint.

Formalin was detected in milk and cream, but in quantities less than one part in 100,000; in one temperance drink it was present to the extent of 1 in 25,000 parts. The accurate quantitative determination of formaldehyde in such quantities as are present in food presents, however, considerable difficulties, and on account of the reactive and changeable character of the substance, such numbers as are obtained give no real idea of the amounts which might have been originally added.

Fisher, 4717, &c. 42. Mr. Fisher pointed out that inasmuch as there are a great many articles which are not purchased for analysis by the inspectors under the Sale of Food and Drugs Acts, it is almost impossible to get any information as to the extent and amount to which preservatives or colouring matters enter into their composition. He had, however, found that 40 per cent. of the butters examined by him, and nearly every sample of margarine, contained boron preservative, whilst cheese, lard and condensed milks were free from it. It would appear also that the samples of milk purchased in his district were also free from preservatives. In such samples of tinned beef, rabbit, and potted meats as he had examined only salt and saltpetre were found.

43. As regards amount, Mr. Fisher found upwards of 1·2 per cent., or 84 grains of boric acid per pound, in butter; 1·0 per cent., or 70 grains per pound, or 87·5 grains per pint, in new cream from Dorsetshire. Sausages contained 0·45 per cent., or 31·5 grains of boric acid per pound. Meat juices sometimes contained glycerine, and sulphites were found in anchovy paste.

From an inquiry which he had addressed to members of the Society of Public Analysts, Mr. Fisher was able to furnish the additional information given in Appendix XII.

44. Dr. Muter, Public Analyst for Lambeth, Southwark, Newington, Rotherhithe, and Wandsworth districts, and the administrative County of Lindsey, Lincs., communicated to the Committee the result of his examination of foods from the above districts during the four months September to December, 1899. The percentage of milks found preservatised each month was 41, 29, 18, and 13 respectively, showing a steady decline on the approach of winter. In all, 650 samples were examined, of which 170, or 36 per cent., were preservatised. Of these, 160 contained boron preservatives and 10 formalin, three containing both these preservatives. With regard to butter, the samples examined were of an inferior class, and almost invariably contained boron preservative irrespective of the month. Bisulphite of lime was found in sausages and salicylic acid in tomato and other sauces.

45. Mr. Cassal, Public Analyst for Kensington, St. George's, Hanover Square, and Battersea, stated that he had found boric acid present, either as such, or as a mixture with borax, or as borax, in sausages, meat extracts, meat juices, potted meats, potted fish, potted caviare, milk, butter, margarine, wine, cream, potted cream, and Devonshire cream. He had found salicylic acid in meat juices, syrups, jams, lager beer, wines, British wines, and lime juice, and formaldehyde in milk; benzoic acid, probably present as benzoate of soda, in non-alcoholic and medicated wines. He had found as much as 100 grains of boracic acid in a gallon of milk and 36 grains in a pound of cream. Such British wines as orange wine occasionally contain as much as 26·6 grains of salicylic acid per gallon, British sherry 11·5 grains, and black currant wine 4 grains. Bottled beer was found to contain 7 grains and Pilsener lager beer 4·76 grains per gallon. Lime juice frequently contains a large amount, as much as 69·3 grains per gallon.

Cassal, 3816–17, 3865.

46. Mr. de Hailes, Analyst to the Dairy Trade Protection Society, whom he represented before the Committee, stated that his experience would lead him to believe that there was an enormous amount of preservative used in the milk trade in London—"far more than anyone has any conception of." Mr. Leonard Boseley, who was chemist to the Aylesbury Dairy Company for four years, stated that about 50 per cent. of the dairymen in London use preservatives, either formalin or boric acid, in amounts varying, as regards borax, from 1 part in 1,000 to 1 part in 10,000. He thought that half the butter sold in London was "preserved."

De Hailes, 3922–23.

Boseley, 956–57, 973, 976, 1013–1015.

47. With regard to jam, Mr. Boseley, as chemist to Messrs. Keiller & Son, stated that certain manufacturers use preservatives, mainly salicylic acid, in every jam sent out. The usual quantity is about 1 part in 3,500, that is ½ oz. of salicylic acid to 1 cwt. of jam.

Boseley, 968.

48. Mr. Vasey, who has been employed for upwards of ten years to examine foods and beverages on behalf of the "Lancet," stated that he had found boric acid in meat-peptone and beef jelly intended for invalid use, and he added that, during these years, practically all the samples of invalid foods which he had occasion to analyse contained chemical preservatives, although more recently he has found certain samples free from indication thereof.

Vasey, 1979–1994.

49. Dr. Hill, Medical Officer of Health and Public Analyst for Birmingham, and Mr. W. Collingwood Williams, Public Analyst for the Boroughs of Blackpool, Blackburn, and Barrow-in-Furness, and Assistant Analyst for the County of Lancaster, the City of Liverpool, and Borough of Bootle, gave valuable information as to the extent to which preservatives are used in their several districts. Thus Dr. Hill, in the four years and a-half ending September, 1900, examined 1,877 samples of milk, taken in Birmingham, for preservatives; of these 184, or 10 per cent., contained either boric acid or formic aldehyde. In 1896 the proportion of milk containing boron preservatives was 8·3 per cent., but decreased steadily to 1·2 per cent. in 1899, with a slight increase again to 2·6 per cent. in 1900. The percentage of samples containing formaldehyde on the other hand increased from 3·3

Hill, 2332, 2385, 2461–63. App. XIII.

per cent. in 1897 to 10·9 per cent. in 1900. The use of both preservatives was more common in summer than in winter. The amounts of boric acid varied from 5 to 126 grains in the gallon; the proportion of formaldehyde ranged from 1 to 5 parts in 100,000, and was often about 2 parts in 100,000. The variable amounts were, in Dr. Hill's opinion, to be explained by the ignorant and careless manner in which the preservatives were introduced—usually by the farmer or the wholesale purveyor—and also by the circumstance that in some cases all concerned in the vending of the milk—farmer, middleman, and retailer—had introduced the preservative.

Voelcker, 1672–1675.

50. Dr. Voelcker, who appeared on behalf of the Royal Agricultural Society, in giving the Committee a number of instances of the use of preservatives in various articles of food and drink, also testified, from personal observation, to the casual and haphazard manner in which both farmers and vendors add preservatives to milk.

Hill, App. XIII.

51. As regards butter, Dr. Hill found that out of 1,159 samples examined during the same time (four and a-half years) 345, or 30 per cent., contained boric acid. Of 143 samples of margarine, including fat-adulterated butter, 120 samples, or 84 per cent., contained boric acid. Of 33 samples of meat foods, such as bacon, ham, and sausages, 21, or 64 per cent., contained boric acid in quantities varying from 10 to 45 grains per lb. Four out of five samples of thick cream contained boric acid, and in one case, salicylic acid in addition; all the samples of clotted cream contained boric acid, which was occasionally found to be present in skim milk and vinegar; five out of six samples of jam contained salicylic acid; it was sometimes found in sherry; out of 11 samples of ipecacuanha wine five were found to have been preserved with salicylic acid. Out of 3,272 samples, the number containing preservatives was 690, or 21 per cent.

Williams, 5149, 5155, 5289, &c.

Williams, 5160.

Williams, 5164-66.

Williams, 5169-70.

Williams, 5176-79.

Williams, 5180.

Williams, 5186.

Williams, 5190.

52. Mr. Collingwood Williams, who stated that about 3,000 samples of food were examined in his laboratory every year, informed the Committee that in Liverpool the milk supply was conducted almost entirely without the use of preservatives; out of 964 samples of new milk, borates were met with in only 4 cases: in skim and separated milk borates were very much more common; out of 294 samples borates were met with in 13 cases. Out of 1,181 samples of new milk examined 10 contained formalin, and out of 1,524 samples of milk altogether, only 15 contained formalin—its more extended employment being, in Mr. Williams' opinion, checked by the success of the Local Authorities in obtaining a conviction for its use. Potted creams were found, as a rule, to contain boric acid. Out of 222 samples of butter 56 contained boric acid, in one case up to 62 grains per lb. Nearly all the samples of margarine contained boric acid. Hams were found to contain it in quantities varying from 4 to 24 grains per lb.; bacon, from 2½ to 8½ grains per lb.; sausages, from 5 to 6 grains; pork-pies, to the extent of 7 grains per lb. of the meat. The greater number of the jams examined contained salicylic acid. Mr. Williams stated that the amount of salicylic acid used in some temperance drinks was "perfectly astonishing," as, for example, lime juice cordial, which was found to contain from 20 up to 108 grains per gallon; lemon squash, 50 grains; ginger wine, from 49 up to 113 grains; raspberry wine, from 87 up to 133 grains; orange wine, from 94 to 106 grains; and black currant wine, from 47 to 140 grains per gallon.

53. Much valuable evidence was given to the Committee by Medical Officers of Health in South Wales, where the authorities appear to have been active in attempting to check a growing tendency to use preservatives.

Jones, 1309.

Jones, 1391-95.

Walford, 1830.

In the case of Newport (Mon.), Dr. Howard Jones stated that the Sanitary Authority had notified to milk vendors and other dealers that no boric acid would be allowed in milk, and that the discovery on analysis of the existence of such preservative to any appreciable extent in butter, cream, preserved meats and other articles of food would render the vendors of such commodities liable to prosecution, and that in consequence preservatives were not much used in the food supply of Newport. Dr. Walford, Medical Officer of Health of Cardiff, stated that in 1898 the Borough Analyst reported to him that 8·5 per cent. of the milk samples he had examined contained boric acid. A later report showed that 13·5 per cent. of the milk samples contained boric acid, in amounts varying from 7 to 14 grains per quart. Of the samples of butter, 44·5 per cent. contained boric acid, in one case to the extent of 71·4 grains per lb.

Walford, 1841-42.

54. Dr. William Williams, Medical Officer of Health to the Glamorgan County Council, who appeared on behalf of the Incorporated Society of Medical Officers of Health, informed the Committee that the Glamorganshire County Council had taken considerable action in regard to boric preservatives, especially in milk and butter. The Local Government Committee of the County Council issued a notice to milk-vendors throughout the administrative county prohibiting the addition to milk of boric acid and analogous preservatives. With respect to butter, it was recommended that in all cases where the admixture of boric acid exceeded 0·5 per cent.—that is, 35 grains per lb., which was double what his Committee was advised was sufficient as a preservative—that prosecution should be instituted. In consequence of this action the proportion of milks containing boron preservative sold throughout the county is very small. Thus in 1897, out of 332 samples examined only 11, or 3·3 per cent., were found to contain boric acid. Prosecutions followed, and in the next year out of 379 samples examined only 3, or 0·8 per cent., were found to contain boric acid. During the first nine months of 1899, out of 265 samples 3 cases of boric acid, or 1·1 per cent., were detected. As much as 210 grains of boric acid per gallon was found on one occasion, in another 140 grains, and in a third 91 grains; in the other cases the amount ranged from 13½ to 56 grains. The action of the County Council had the result also of gradually reducing the amount of boracised butter sold throughout the district. Thus in 1897, out of 82 samples, 37, or 45·1 per cent., were found to contain boric acid in amounts varying from one or two grains up to 112 grains per lb. Prosecutions followed in a number of instances, with the result that in the next year the ratio of "preserved" butters fell to 34·1 per cent., and in 1899 to 26·5 per cent. In no case during 1899 was the amount of boric acid in excess of 35 grains per lb.

Williams, 2111.
Williams, 2129.
Williams, 2137-38.
Appendix XIV.

55. In other parts of the country preservatives seem to be employed to a much greater extent, depending apparently upon the attitude of the Local Authority towards their use. Thus as regards Leeds, Dr. Cameron, the Medical Officer of Health, stated that during the month prior to his appearance before the Committee, out of 49 samples of milk examined by the Public Analyst, 25, or 51 per cent., contained boric compounds of some kind.

Cameron, 2528.

Mr. Brierley, Public Analyst for the County Borough of Southampton and for the Borough of Newbury, said that the ordinary practice in the neighbourhood of the borough of Southampton was, in the summer months, to take one pound of the preparation (boron preservative), dissolve it in one gallon of water, and add one pint of the solution to eight gallons of the milk. This is equivalent to about 100 grains of the substance to the gallon, or a little over 12 grains to the pint. In Hampshire this addition of preservatives is done mainly by the large wholesale dealers, and the practice is increasing. "It is more difficult in the summer months to get samples that are free from these preservatives than it used to be." "Both formalin and boracic acid preparations are being increasingly used." The printed statements as to the amounts to be used are not always followed. "There are agents for the makers who go about and canvass for customers, and they give them information on their own account, which is not the prescribed amount." "In Southampton there are chemists who are selling boric acid pure and simple, without any instructions whatever to these people, for the purpose of adding to milk. It is sold to farmers in that way."

Brierley, 3174.
Brierley, 3208, 3216.
Brierley, 3214.

Mr. W. F. Lowe, Public Analyst for the Counties of Flint, Carnarvon, Anglesey, and Denbigh, and for the City of Chester, also testified to the frequent presence of boric acid in milk, cream, and butter. In butter he had found it to the extent of from 8 up to 50 grains per lb., and in milk and cream from 6 to 20 grains per pint. (Appendix XVI.)

II. COLOURING MATTERS.

Nature of the colouring matters in use.

56. With regard to artificial colouring matters it is worthy of note that the crude and gross sophistication of foods with mineral colouring matters known to be more or less poisonous (as, for example, lead chromate, vermilion, Scheele's green, etc.), appears to be a thing of the past.

Sulphate of copper is, however, still extensively used in the colouring of peas and other green vegetables. Out of 47 samples of preserved vegetables examined in the Government Laboratory, 17, or about 35 per cent., had been treated with sulphate of copper.

Armenian bole (the colouring principle of which is red oxide of iron) is occasionally used for sausages, potted meats, anchovy and bloater pastes, sweets, etc., etc.; but this mineral matter, together with camwood and logwood, which were formerly used for a similar purpose, are now being superseded by the red coal-tar colours referred to below. Armenian bole was found in only 6 out of 279 samples of preserved meats, etc., examined in the Government Laboratory. Mr. Fisher found it in anchovy and bloater pastes (4 samples out of 6), and Mr. Cassal in sweets.

Fisher, 4771.
Cassal, 3847.

Graphite, used to face and "improve" the colour of peppercorns, occurred in two samples examined in the Government Laboratory.

Boseley, 1050.

57. The most commonly used colouring matter for dairy produce is annatto, a vegetable extract from *Bixa orellana*. This, and certain other yellow colouring matters of vegetable origin (as turmeric, saffron, etc.) have generally been considered harmless in the quantities employed, but they are gradually being superseded by coal-tar yellows, the action of which upon the human system is not fully known.

Butter from Holland, Australia, and the United States is very frequently coloured with coal-tar yellows. A large number of margarines are also so coloured.

The coal-tar yellow most frequently employed for dairy produce and margarine is known commercially as "butter-yellow," its chemical title being "dimethyl-amido-azo-benzene." Tropœolins, which are sulphonated-azo derivatives from coal-tar, are also coming into use.

"Butter-yellow" is generally supplied to the trade ready dissolved in oil, either cotton-seed, rape, linseed, or sesame oil.

App. XI., Table B.

Smith, 4467–70.

58. Mr. T. Carrington Smith, representing the Central Chamber of Agriculture, gave the name of thirteen brands of colouring matters mentioned in 110 replies to a circular addressed to dairy farmers and traders. Of these, "annatto" was said to be used in 42 instances, but the colour basis of many of the other colours mentioned (which are identical with some of those examined in the Government Laboratory) was also annatto, though sold under a fanciful name. In two cases the colouring material was carrot juice.

59. The colours to be obtained from coal-tar are practically unlimited in variety, and their tinctorial power is so great that very small quantities suffice to produce the required tint. They are consequently coming into increasing favour to replace the red, yellow, orange, green, blue, and violet colours required for jams, temperance drinks, sweets, and confectionery.

60. The great majority of the coal-tar dyes used for colouring foods belong to the "azo" class, and are usually sulphonated when required to be used in a form soluble in water. A mixture of an "azo" red and a brown allied to Bismarck brown is used for imitating the smoke colour of hams.

Other coal-tar colours which have been identified in the Government Laboratory were "Ponceau red," and "citron orange" in temperance beverages; "crocein orange," "citron orange," "auramin," "rose pink," and "fuchsin," in fruit, jellies, and jams; "Congo red," "fuchsin," and various sulphonated azo-reds in sausages (in the meat itself in some cases, but on the outer skin only in the case of poloneys); acid-yellow (mixed with Bismarck brown in some cases) for colouring sugar crystals; the object being either to "improve" the colour of genuine sugar or to give to beet-root crystals the fictitious resemblance of West Indian sugars. West Indian so-called Demerara sugars are usually tinted by the use of chloride of tin; but this practice, we understand, is about to be discontinued. (See Appendix XVII.)

61. The following coal-tar colours were identified by various public analysts.

Mr. Fisher, President of the Society of Public Analysts, found diazo-colours (both yellow and red) in table jellies; eosin and tropœolins in sweetmeats. Messrs. Allen (Sheffield) and Keating Stock (of Durham) identified "Congo red" in sausages, and Mr. Stock a colour resembling "benzo-purpurin" in jam. Mr. Gatehouse (Bath) has met with an eosin dye in meat foods, and yellow and brown aniline dyes in sugars. Mr. Bodmer (Southwark) also found a red aniline colour in meat foods. Mr. Droop Richmond (of the Aylesbury Dairy Company) stated that whilst annatto is most commonly used for dairy products, coal-tar yellows of the tropœolin group are also frequently employed.

Fisher, 4793-94.

Richmond, 5760.

Mr. Leonard K. Boseley, chemist to Messrs. Keiller and Son, supplied the Committee with a list of coal-tar dyes (comprising most of those above mentioned) used for colouring sweets. These, consisting of various red, pink, orange, yellow, brown, black, blue, and violet colours, will be found in Tables P and Q of Appendix VIII., with their commercial and scientific names and the quantities recommended for use. (See also Appendix XVIII.)

Colouring matters supplied by traders.

62. Twenty-nine samples of colouring matters as supplied to the trade ready for use, were examined in the Government Laboratory. (See Appendix VIII., Table O.)

It will be observed that out of 17 samples of colour used for dairy produce, 13 consisted of annatto dissolved either in water (sometimes alkaline) or in oil. The cream colour was a mixture of annatto and a tropœolin, and the remaining three were coal-tar yellows dissolved, in one case, in an alkaline aqueous solution, the rest being dissolved in oil.

In the case of sausages, the colours are in some instances recommended for use on the outer skins only; in others they are to be mixed with the sausage-meat. The "brown dye" is used only externally for giving hams the appearance of having been smoked.

63. The extent to which colouring matters were found in the foods examined in the Government Laboratory is shown in Appendix VIII., Table N. Only 3 samples of milk out of 296 examined, or 1 per cent., gave positive evidence of annatto. The number of artificially-coloured samples of cream was 10 out of 290, or 3·4 per cent. (the colour being a coal-tar yellow in 9 out of 10 of the coloured samples); butter, 127 out of 364, or 35 per cent., of which one-third contained coal-tar yellow, the remainder being coloured with annatto in 84 cases and turmeric in three others; margarines, 109 out of 133 samples, or 82 per cent., 100 of these being coal-tar yellow, the rest annatto; cheese, 111 out of 196 samples, or 56·6 per cent., the great majority (167 samples) being coloured with annatto; sausages, 74 out of 226, or 33 per cent. This does not include samples coloured on the outer skin only, but only those in which the colour used was added to the sausage meat. The colour was in nearly all cases of coal-tar origin. Fruit jellies, syrups, and cordials contained 46, 58, and 56 per cent. of coloured samples respectively, the colour being almost invariably one of the coal-tar derivatives. Of 10 samples of sauces and ketchups, 5 contained coal-tar yellows and 3 turmeric. Sugars: 24 out of 149, or 16 per cent., were coloured with coal-tar dyes. Temperance drinks: 57 out of 769, or 7 per cent., were artificially coloured, 56 out of the 57 being coal-tar colours.

64. Caramel was present in many samples of temperance drinks, and is frequently used as an artificial colouring in wines, spirits, etc., but as it

enters into the ordinary preparation of many articles of food, and is acknowledged to be harmless, it has not been included in the list of colouring matters. The animal colouring in Table N refers in all cases to cochineal. This was found in only 11 samples, chiefly fruit jellies and cordials.

65. The number of samples of milk and cream artificially coloured is probably greatly in excess of that given above, as only those cases are recorded in which the presence of an artificial colouring matter was detected with certainty. Many cases were doubtful owing to the minute quantities of colouring employed, and to the fact that the characteristic reactions for the colouring agents are frequently interfered with or obscured by the organic matter of the food itself, especially after decomposition has commenced.

Amount of colouring matter.

66. The actual amount of the colouring principle, whether as prescribed by the trader, or as it occurs in the food, cannot be stated with any approach to accuracy (except in the case of mineral colours, as sulphate of copper and oxide of iron), owing, in the former case to the varying strengths of the colour preparations and the indefinite directions for use, and in the latter to the want, at present, of satisfactory methods of estimating the relatively small amounts of colour employed.

Richmond, 5759.

Mr. Droop Richmond gives the amount of annatto in milk as roughly 1 in 300,000 parts, and in butter 1 in 100,000 parts, and states that the amount of the commercial colour used is about 10 times that of the pure colouring ingredient contained in it.

Boseley, 1050, 1056.

App. VIII., Table Q.

Mr. L. K. Boseley also states that the actual proportion of annatto added to milk was on the average about 1 in 300,000 parts; that turmeric is added to piccalilli to the extent of 3 lbs. to a 40-gallon barrel; and that sulphuric acid in the proportion of 3 oz. to a 40-gallon cask is used to intensify the red colour in pickled cabbage. He also found that the proportion of coal-tar dyes used in confectionery (sweets) varies from a maximum of 1 in 2,000 or 3,000 to a minimum of 1 in 33,000.

Mr. Cassal found as much as 0·8 per cent. or 56 grains per pound of ferruginous earth (containing 0·4 per cent. or 28 grains per pound of oxide of iron) in sweets.

App. VIII., Table R.

67. The maximum amount of copper sulphate in peas recorded during the present enquiry is 0·094 per cent. or 6·6 grains per pound calculated as metallic copper, or approximately 26½ grains of crystallised copper sulphate per pound.

Vasey, 2005, &c., Blyth, 3423–25, App. VIII., Table R. Williams, 5343. Copeman, 1215, 1240.

Prof. A. W. Blyth and Messrs. Vasey, Lowe, and Cassal have found amounts varying from 2½ to 6 grains of copper sulphate per pound. Mr. W. Collingwood Williams examined peas having a very pronounced green colour, when only ¼ grain of copper sulphate per pound was found. Mr J. W. Copeman, representing the London Chamber of Commerce, considers that 2 grains of copper sulphate per pound of peas is the minimum amount necessary for the trade, and that the maximum might be fixed at 2·7 grains.

For amounts of colouring matters found by different observers in various kinds of food, see Appendix VIII., Table R.

Brierley, 3173, 3207–9, 3274.

Bennett, 232.

68. Convinced as we are of the very general and increasing use of chemical preservatives by traders in the more perishable articles of food, we desire now to focus the evidence which has been placed before the Committee as to whether such preservatives may be expected to be attended with any risk to the public health.

69. It should be borne in mind that under the conditions in which the population of Great Britain lives, and more particularly that portion of it inhabiting the large towns, some preserving agent, not necessarily chemical, appears to be needed in the case of no inconsiderable portion of its perishable food supply. It is common knowledge that the food producing capabilities of this country do not suffice in all particulars for the needs of its population. Under these circumstances

the total prohibition of preserving methods would clearly be likely to be attended with serious results to the public health, in that large quantities of food possessing highly nutritive value might in effect either be withheld from the poorer classes, or be liable to be consumed by them in a condition of incipient putrefaction. Obviously, if an animal killed to-day were kept under conditions favourable to putrefaction, the meat of such animal would be unfit for human consumption on the morrow. In this instance the preservative method employed is to place the meat under conditions as antagonistic to putrefactive changes as local circumstances will allow.

70. The question appears to resolve itself into this: Are any of the substances at present used for preserving or colouring foods or drinks likely to be so harmful to the health of the consumer as to call for their prohibition, limitation, or declaration?

71. The evidence given before the Committee bearing on this question, which constitutes the first part of our reference, may be classified as that of

A. The Public Analyst.
B. The Medical Officer of Health.
C. The Physician and Surgeon.
D. The Physiologist and Pharmacologist.

A.—THE EVIDENCE OF THE PUBLIC ANALYST.

72. We have already referred at considerable length to the evidence given before the Committee by Public Analysts. Such evidence has been directed mainly to the extent and to the amount in which preservatives and colouring matter are in actual use. Therefore, it is only necessary to refer briefly to certain points which seem to us to have a definite bearing upon the question whether the practices already described are likely to be attended with danger to health.

73. It has been shown that the prosecutions which have taken place in recent years have exercised an inhibiting effect upon the use of preservatives. In estimating, therefore, the value of the evidence furnished by public analysts, regard must be had to this fact.

The potential danger from the use of preservatives and colouring matters can be best estimated by a consideration of the maximum amounts of one or another preservative which have been found in actual practice.

74. Although the maximum amounts referred to must, at any rate in certain instances, be regarded as exceptional and unnecessary, the important point to bring out is that there is no guarantee whatever that such excessive amounts may not continue to be used. The prevailing opinion of the public analysts who appeared before us was that some system of control was necessary, and that, as regards milk, large quantities of which are consumed by invalids and infants, this should amount to total prohibition. Some were in favour of limiting the amount of preservatives used in other articles, and of labelling them with the nature and amount of such preservative.

75. With regard to the precision with which such limits could be determined, many witnesses gave evidence. There was some difference of opinion among them, but as regards formalin, the evidence was unanimous that at the present time the estimation of such minute quantities as may be present in foods is attended with great difficulty.

77. As to colouring matters the general testimony was to the effect that the nature and amounts of the substances in general use at the present are such that but little danger is likely to accrue to the public health therefrom. There were, however, certain analysts who advocated that the example of Belgium and certain other countries should be followed, and that schedules should be drawn up containing a list of the substances to be regarded as harmful and those to be regarded as harmless.

B.—THE EVIDENCE OF THE MEDICAL OFFICER OF HEALTH.

78. It was to be expected that the medical officers of health throughout the country, and more particularly those whose districts are urban in character, would have had evidence of value to put before the Committee as to actual harm occasioned by the use of foods and drinks containing preservatives or colouring matters. More particularly might this have been expected to have been the case in dealing with an article of food such as milk, which is daily consumed in large quantities, and which is, moreover, habitually under suspicion as a vehicle for the dissemination of diseases such as scarlet fever, enteric fever, and diphtheria.

Williams, 2108–2258.
Hill, 2325–2522.

79. Therefore we invited the Society of Medical Officers of Health to appoint delegates to appear before us. The evidence of both the nominated delegates was opposed in general principles to the use of preservatives, and they conveyed a resolution from the Society to the effect that—

Hill, 2522.

"The Society strongly disapproves of the practice of adding preservative chemicals to milk and other foods. That if preservative chemicals are added to any food a full disclosure as to their nature and amounts should be made to the purchaser."

Williams, 2146.
Hill, 2446.
Corfield, 5128.
Robinson, 3301.
Tubb-Thomas, 4926.
Kaye, 5503.
Walford, 1897.
Cameron, 2539.
Kaye, 5477.

80. When, however, we examined the ground upon which these conclusions were based, we found that the instances of actual harm which were alleged to have occurred from the consumption of articles of food and drink chemically preserved were few in number, and were not all supported by conclusive evidence. Certain medical officers of health admitted that they could give no cases of illness which they had suspected might have arisen from the use of chemical preservatives in foods or drinks. In other instances, however, we were told either of isolated cases or groups of cases in which boric acid or borax was thought to have been the cause of the mischief. For example, the Medical Officer of Health for East Kent did not hesitate to attribute the serious simultaneous illness of five ladies to their having partaken of milk preserved with "glacialine" (a boracic compound), and described how some blancmange prepared with this milk was afterwards given to nine fowls, five of which died. Certain of these witnesses thought that the persistence, in spite of the gradual improvement of sanitation, of the high infantile mortality during the third quarter of the year might possibly be partly explained by the increasing use of chemical preservatives in milk.

Hill, 2499.
Robinson, 3335–37.
Hope, 6888.

81. The medical officers of health, however, were practically unanimous in their opinion that all preservatives should be prohibited in milk. In their opinion the use of these substances in milk was quite unnecessary, was likely to put a premium upon cleanly methods of milk collection and storage, and was, upon general principles, likely to be dangerous to the well-being of children, invalids, and adults in certain conditions of health. Generally speaking, the contention of these witnesses was to the effect that the burden of proving the harmlessness of these substances—the most commonly used of which were drugs employed in medicine—should rest with those using them, and that there was no sufficient reason, from the point of view of necessity, why the public should be drugged against its will, and in ignorance of the fact that it was so being drugged.

Walford, 1879–81.
Williams, 2213.

82. Furthermore, certain of these witnesses, all of whom, it may be noted, were medical men, saw danger from the unknown administration of these drugs in morbid conditions of the body which are believed to contra-indicate the administration of these drugs, and they pointed out that such drugs are at times used in amounts far in excess of those sanctioned by the British Pharmacopœia.

Hill, 2447.
Cameron, 2578.

83. It was contended, in effect, by certain witnesses that when more attention is paid by medical men to the subject of the use of preservatives, obscure and sometimes transient conditions such as indigestion, malaise, faintness, etc., which at present receive no adequate explanation, may be found to be partly explained by the use of preservatives which are regarded as being likely to produce one or another of these symptoms.

C.—THE EVIDENCE OF THE PHYSICIAN AND SURGEON.

84. It seemed to us that material assistance might be derived from the medical profession as to the expediency, or the reverse, of allowing the use of chemical preservatives in food, more especially in a substance such as milk, which is largely used, and at times exclusively, by infants and invalids. Indeed there are very few morbid conditions, whether febrile or other, in which the use of milk as a food is not sanctioned.

85. The evidence which was tendered from this source was not very conclusive in its nature, and it was soon evident that the question of food preservatives had not at the time of our inquiry received special consideration by the medical profession.

Hutchison, 6727–28.

86. The Surgeon of the General Hospital, Nottingham, gave it as his experience that boracic acid taken in daily doses of 10 to 20 grains is generally followed by dyspepsia, "sufficiently pronounced to make life miserable while it lasts, and at times it causes distinct gastritis, with repeated vomiting." Sir Lauder Brunton considered that boracic acid was capable of exercising an injurious effect upon pregnant women.

Anderson, 7188.
Brunton, 7463.

87. On the other hand, an assistant physician at the London Hospital described extended experiments as to the effects of borax and boracic acid upon himself, which resulted in "no sort of stomach irritation or intestinal irritation or trouble, or anything of that sort at all."

Hutchison, 6693.

The consulting surgeon to Westminster Hospital stated that he had administered borax to "hundreds of patients" in doses of 10 grains three times a day and up to 40 grains a day, and never found any evil or unpleasant effects, except in those patients who, having kidney disease, could not void the drug readily.

Bond, 3064.

88. In so far, however, as expression of opinion went, the profession was almost unanimous in its condemnation of the present unrestricted use of preservatives. The medical profession was clearly impressed with the importance of at least intimating, by a system of labelling, the nature and, where practicable, the amount of the preservative used. In the opinion of Sir Lauder Brunton and other witnesses it is a serious matter that a medical man should prescribe a daily dose of any drug to a patient who may, unknown to himself and the physician, be consuming an indefinite quantity of the same drug in his food. He also pointed out that by the indiscriminate employment of drugs there was a possible danger that the action of certain drugs might be, if not entirely nullified, at least reduced in effect.

Hutchison, 6722–49.
Brunton, 7427.
Womack, 7479.
Brunton, 7458.

89. There was, however, another aspect of the question to which certain witnesses referred. They were of opinion that there are certain conditions of the human economy in which the administration of drugs, such as boracic acid and salicylic acid, are held to be contra-indicated. Among such conditions specific reference was made to inflammatory states of the kidneys, certain states of the digestive tract, and of the reproductive organs.

Wild, 1427.
Bond, 3084–3108.
Wild, 1468.
Dixon Mann, 2615.
Bond, 3142.
Lauder Brunton, 7463.
Womack, 7494.

90. It was pointed out by several witnesses that, inasmuch as certain of these conditions are likely in the aggregate to be of considerable prevalence, it is a matter of importance that persons suffering from such conditions should be protected from the danger to which the unregulated use of drugs might conceivably expose them.

Hutchison, 6736.
Still, 6806, 6810.

D.—THE EVIDENCE OF THE PHYSIOLOGIST AND THE PHARMACOLOGIST.

91. The physiological and pharmacological evidence which has been given before the Committee may be divided into that which rested upon opinion and that which comprised the results of actual experiments.

92. It may be said at once that all these witnesses strongly deprecated the unregulated use of preservatives, at least those at present known, and of

Starling, 6940.
Halliburton, 7548–50.

Poore, 7368.

any colouring matter having a possible deleterious action upon the human system, and were generally agreed that formic aldehyde was a dangerous substance, even in very dilute solution.

Halliburton, 7528.

MacFadyean, 1798.

93. An opinion inimical to the use of preservatives, either declared or undeclared, was also held by certain of these witnesses, on the ground that these substances were added to food for the purpose of destroying or preventing the development therein of living organisms, and hence that these same substances when introduced into the highly organised animal could not behave indifferently to living matter, but must also tend to exert upon it some influence. Especially, they maintained, was this the case since the secretion of the digestive juices was dependent upon the activity of cells not differing sufficiently from micro-organisms to render it probable that substances affecting deleteriously the one would be indifferent to the other. Moreover, it was alleged that, apart from this, the activity of digestive ferments might be prejudicially affected. One witness maintained that the mere fact that we are unable to measure, or with the means at present at our command even to identify, the injury produced by preservatives by no means negatives the possibility of such an injury occurring.

94. The *a priori* objections of physiologists to certain preservatives and colouring matters also rested upon the fact that they are foreign to the animal body, and that the continued ingestion of these could not be treated with indifference.

Halliburton, 7548, 7583–85.

95. Other objections offered by the physiologists applied especially to one preservative, viz., formalin (40 per cent. aqueous solution of formic aldehyde), and were based upon the fact that this substance actually enters into combination with the proteid constituents of the food, the compound formed being less digestible than the original substance, thereby entailing a nutritive loss to the consumer.

Hutchison, 6719.
Brunton, 7427.

96. At the same time other witnesses testified to the value of chemical preservatives in protecting consumers from the evils of tainted or decomposing food. One witness said that, in his opinion, the use of preservatives, even in milk, under certain conditions, was in the public interest.

Annett, 2641, 2647.
Rideal, 3688.
Halliburton, 7583–85.

97. The physiological experimental evidence laid before your Committee by the witnesses consisted for the most part either of the results of digestive experiments *in vitro*, or of experiments made upon the influence of formic aldehyde and boracic acid and borax upon animals. One witness described a series of observations upon himself with boric acid. He found that when he consumed pharmacopœial doses of boric acid that this substance taken with his meals had no appreciable action upon the digestion of his food. He found also that salicylic acid did not interfere with the digestion of his food.

Attfield, 6504.

Womack, 7942.

98. The experiments on digestion *in vitro* were concerned with formic aldehyde and boracic acid and borax; speaking generally, the results of these experiments may be regarded as showing that each of these substances had a retarding effect upon certain digestions; this amounting in the case of strong solutions of formic aldehyde to marked inhibition.

Starling, 6963.

99. The evidence derived from experiments upon animals has been exceedingly scanty. One witness laid before the Committee the results of certain experiments he had made upon the influence of boric acid and formaldehyde upon young kittens, which showed that both these substances had a deleterious influence upon these young animals. Another witness, however, working apparently under approximately similar conditions, obtained different results.

Annett, 2641–47.

Rideal, 3688.

100. With regard to the question of colouring matters in food the physiological evidence given before the Committee was in the main limited to the question of metallic substances, and chiefly to the effect of the addition of copper sulphate to vegetables for the purpose of imparting to them an artificial colour. Physiologists seemed agreed that if copper sulphate were allowable for this purpose its presence should be declared, and preferably

also its amount. As to whether the addition of copper sulphate should be prohibited or not there was not the same agreement. Only one witness brought forward any experimental results upon this subject. He made certain digestive experiments *in vitro* which, in his opinion, justified the conclusion that in the human subject the chlorophyll copper compound which exists in the artificially "greened" vegetables is soluble and absorbable. Cameron, 2549–52.

101. Apart from actually ascertained facts, the objection to the presence of compounds of copper in preserved vegetables, even when declared, rested, in the opinion of certain witnesses, upon the fact that this substance is, strictly speaking, foreign to the animal body, and hence their constant ingestion, assuming them to be absorbed, cannot be regarded with indifference.

102. Other witnesses, however, regarded the ingestion of such small quantities of copper compounds as unlikely to be attended with any appreciable harmful effect upon the consumer. One witness pointed out to the Committee that certain individuals may possess a great liability to become poisoned by copper. Brunton, 7468. Dupré, 5922.

With regard to other colouring matters practically no physiological evidence was placed before the Committee.

CONCLUSIONS.

103. It now remains to consider the general trend of the evidence placed before the Committee.

104. The medical evidence, speaking generally, comprises for the most part opinion arrived at after a general consideration of the issues involved, but such opinion was not always based *directly* upon fact. The physiological evidence consists of the citation of the results of more or less exact physiological experiments. But, unfortunately, in the majority of cases the conditions under which the experiments have been made have only partially imitated those conditions which obtain in the actual taking of preservatives by the human subject of all ages for indefinite periods of time.

105. Further, even supposing that we were to assume that the physiological experiments which have been laid before us did imitate with sufficient exactness the actual conditions obtaining in the inquiry in point, they would certainly only do so in so far as relates to the use of one preservative during a given period of time. The facts, however, show that in ordinary life what actually occurs is the simultaneous ingestion of more than one preservative. A further condition almost impossible of imitation by the physiological investigator is the consumption of these preservatives by all classes of invalids and by sucklings. The absolute effect of these substances upon sucklings is at present unknown, and it is also practically impossible to infer with accuracy from facts at present ascertained what would be the effect of, for instance, formic aldehyde upon a patient suffering from uræmia.

106. A factor still more subtle in its influence upon the question before us is idiosyncrasy. Certain individuals are extremely sensitive to certain drugs, and it appears that among these drugs must be reckoned at least one of the agents used as a preservative. Although legislation covering all possible idiosyncrasies would be too complicated to be practical; nevertheless, it must be pointed out that as matters are at present, an individual possessing an idiosyncrasy with regard to the poisonous action of boracic acid would not be able to profit even by his own experience. For since the addition of this substance to foods is not declared he might be continually made ill by the repeated involuntary consumption of articles of food containing it.

107. The actual material upon which to base trustworthy conclusions has not existed heretofore, in that the declaration of preservatives, and and also a regulation of and notification of the amount thereof present in any preserved food must be regarded as a necessary preliminary to any accurate observations or statistics upon the subject. Had declaration of preservatives been in force during recent years, we should probably now have been in possession of medical evidence more directly based upon fact than that which we have had laid before us.

108. Notwithstanding the fact that trustworthy data as to actual injury are but few, there is evidence pointing to the probability that such injury does at times accrue. We cannot overlook the danger to which the uncontrolled use of drugs in the food of the population may be likely to give rise.

109. Compounds of boracic acid have not been proved to be more hurtful than saltpetre to the consumer, yet saltpetre has been used from time immemorial in curing bacon, &c. The modern use of borax and boracic acid has enabled producers to dispense with a large proportion of common salt formerly necessary, thereby rendering bacon far milder to the palate, and protecting it from taint and fly-blow.

Bennett, 151, 171, 192. Gregson, 888. Faber, 4237. Bennett, 232. Harris, 5955.

110. Although the greater number of the witnesses disclaimed any knowledge that boracic acid or borax is actually injected into the carcases, we are convinced from our own observations, as well as from the testimony of certain witnesses, that these preservatives are used in the curing of hog products, ham having found to contain amounts varying from 4 to 24 grains per lb., and bacon from 2½ to 8½ grains per lb. The use of boron preservatives, which began about 20 years ago, is now very general in the import trade in bacon and ham. No doubt they are exceedingly convenient, but that they are not indispensable is proved by the success of a large and well-known firm of exporters of Wiltshire bacon, which uses no antiseptics but salt and saltpetre.

111. Concerning the physiological effects of the sulphites, a preservative often used by butchers, poultry dealers, and brewers, there has been no evidence laid before this Committee. It appears, however, that when sulphurous acid or its salts are added to organic compounds such as beer or butchers' meat, some is at once oxidized to sulphate, which may be regarded at any rate in the amount present as indifferent; some attaches itself chemically to certain constituents of the food in question and the compound formed is also innocuous; a third portion remains as sulphurous acid, and it is this portion alone which is of permanent efficacy as an antiseptic. Concerning the effect of this moiety upon the consumer pharmacologists do not seem agreed, and further investigation is required before the sulphites can be regarded as either harmful or harmless.

112. After very carefully weighing the evidence we have come to the conclusion that as regards the trade in fresh and cured meat, fish, butter, margarine, and other food substances in the consumption of which but small quantities of the antiseptic are taken into the system, there exists no sufficient reason for interfering to prevent the use of boron preservatives. Even butter, of which the imports from all countries except Denmark frequently contain boracic acid, is not consumed in such quantities by individuals as to convey more than a very moderate daily amount of the drug into the system. The evidence satisfies us that the amount of preservative corresponding to 0·5 per cent. of boracic acid is sufficient for the purpose of preserving butter.

Hutchison, 6759. Hope, 6830, 6841. Still, 6787. Wild, 1436.

113. But the circumstances and considerations affecting the milk traffic are very different. Milk, a very perishable substance, peculiarly liable to bacterial contamination, forms a very large proportion of the daily food of the public. The nutrition of infants and young children depends greatly on the purity and abundance of the milk supply; and, seeing how frequently milk is prescribed for invalids and convalescents, it is of the utmost importance that it should not be the vehicle of any unsuspected agent. While it is possible that milk containing boracic acid in sufficient quantity to act as a preservative (say 30 grains to the gallon) might be consumed to the amount of four or five pints a day, without harmful results by most healthy children or adults, there is evidence pointing to an injurious effect of boracised milk upon the health of very young children.

Hill, 2334.

114. Moreover, there exists at present no guarantee against the addition of excessive amounts of preservative to milk. In 1896 the Medical Officer of Health for Birmingham estimated the amounts of boracic acid in a

number of milk samples. Of these, one-half showed boracic acid in a proportion not exceeding 21 grains per gallon; in one-fourth the proportion varied between 21 and 42 grains per gallon; while in the remaining fourth it ranged from 42 up to 126 grains per gallon. Professor Blyth instanced a sample of milk, purchased in Marylebone, containing boracic acid in the proportion of no less than 80 grains to the pint. This occurred in December 1899, and the witness assured us that from time to time he had found an equally high proportion in milk samples taken in summer.

Blyth, 3439–40.

115. Clearly such random use of any drug in a food calls for regulation. At present milk may be subjected to several successive treatments with preservative before it reaches the consumer. The farmer or producer sometimes applies it, so does the wholesale purveyor, so does the retail dealer; lastly, the domestic use of preservatives is increasing, and has become very general, and hence the milk may receive a fourth dose before it reaches the unsuspecting consumer.

Brierley, 3183, 3188.
Table A., Appendix XI.
Long, 4604.

116. There is this further objection to the use of preservatives in the milk traffic, that they may be relied on to protect those engaged therein against the immediate results of neglect of scrupulous cleanliness. Under the influence of these preservatives milk may be exposed without sensible injury to conditions which otherwise would render it unsaleable. It may remain sweet to taste and smell and yet have incorporated disease-germs of various kinds, whereof the activity may be suspended for a time by the action of the preservative, but may be resumed before the milk is digested.

117. It has been put before us that it is not possible to supply large towns, especially London, with new milk without the aid of preservatives; but we have received abundant evidence to prove that this is no more than a matter of organisation and system. No doubt the prohibition of preservatives in milk offered for sale would tend to the disadvantage of small retailers who have no cold storage, but this is not a consideration which should stand in the way of a much-needed reform.

De Hailes, 4031
Hutchison, 6751–52.

As to the feasibility of conducting the traffic in the largest towns without preservatives we have no doubt whatever. In Denmark the use of all preservatives in milk is strictly prohibited, and the prohibition is stringently enforced. Much of the milk consigned from the country to Copenhagen is conveyed in ice wagons or wagons otherwise specially adapted for the traffic, the property of purveying companies in the capital.

Appendix III.

118. It has been estimated that about 50 per cent. of the dairymen of London use preservatives. One of the largest dairy companies in London (Welford Dairy Company, Limited) declined to furnish us with any information; but evidence was given by another large company (the Aylesbury Dairy Company, Limited) that they used no preservative whatever, either in milk, cream, or butter.

Boseley, 956.
Richmond, 5641.

119. Even more conclusive of the practicability of supplying the metropolis with milk unmixed with preservative was the evidence of Mr. T. Carrington Smith, who, during a series of several years, consigned milk to London from mid-Staffordshire, a distance of 126 miles, under a contract which prohibited him from the use of preservatives. The milk was carefully strained and cooled by means of water, precautions which the witness pronounced indispensable, and there never was any trouble from the milk going sour. Mr. Smith, who appeared on behalf of the Royal Agricultural Society, handed in letters from farmers sending the milk of from 500 to 1,500 cows daily to London from Faringdon and Didcot, without the use of preservatives.

Carrington Smith, 4414
Carrington Smith, 4506.
Carrington Smith, 4431.

120. In face of these facts we are of opinion that it is idle to pronounce it impossible to supply London with milk not artificially preserved. The business would be attended with some inconvenience at first, but we are impressed with the need for facing that inconvenience, and for rendering

the vendors of milk containing preservatives subject to penalties under the Sale of Food and Drugs Acts. Obviously the conditions under which milk is sometimes kept in the homes of the poor is likely to hasten the processes of decomposition, but we do not think this a sufficient argument in favour of the sale of chemically preservatised milk.

McCracken, 2869.

Cassal, 3820.

121. In regard to cream the question is somewhat different. We are of opinion that, under present conditions, it would be difficult to maintain or increase the present supply of cream without the use of some preserving agent. The presence of a preservative is less objectionable in cream than in milk, because cream is usually consumed in much smaller quantities than milk; but inasmuch as cream is now often prescribed for invalids and children instead of cod-liver oil, we consider that the obligation should be laid on the vendor of cream of notifying the presence, nature, and quantity of the preservative.

122 One of the considerations which render it expedient to prohibit the use of any preservative in milk offered for sale, namely, the large quantity which may be taken into the system of the consumer, places, in our opinion, wine, cider, and temperance beverages upon a very similar footing. Moreover, while by far the greater proportion of preservatives used in the dairy industry consists of compounds of boron, a substance without any active toxic properties, it is otherwise with fermented and temperance drinks. The usual preservatives in these articles are salicylic acid and formaldehyde, and although the quantity of each actually required is very small, it is often largely exceeded.

W. C. Williams, 5187.

Blackwell, 4875, 4885.

123. Thus the Public Analyst of Blackpool, Blackburn, &c., found in sweetened lime juice cordial, "consumed," as he said, "considerably at children's parties and such like festivities," amounts varying from 20 grains to 108 grains of salicylic acid per gallon. That the use of any preservative whatever in such drinks is unnecessary was proved to us by one of the largest manufacturers in this country, who stated that his firm never use them at all, although he considered that it would be convenient to do so.

Radcliffe-Cooke, 6576, 6604, 6607.

Symons, 7264–65, 7285.

124. As stated above, we have not given attention to the prevalence of preservatives in beer, that matter having been threshed out so recently before the Beer Materials Committee; but in the manufacture of cider we found that the employment of salicylic acid is very general, both in the native and imported article. While one cider manufacturer told us that he used no preservative, another strongly advocated the use of salicylic acid.

Appendix I.

125. As regards wine, whether British or imported, we are of opinion that wine which cannot be made or kept without the use of a preservative had better not be offered for sale. We are confirmed in this view by the action of the Government of the chief wine-producing country in the world, namely, France, which by the law of 11th January 1891 absolutely prohibited the use in wine of all preservatives (except chloride of sodium or common salt to the extent of 1 gramme per litre) and of all colouring matters whatever.

Attfield, 6572.

126. In regard to the colouring matters of modern origin, while we are of opinion that articles of food are very much preferable in their natural colours, we are unable to deduce from the evidence received that any injurious results have been traced to their consumption. Undoubtedly some of the substances used to colour confectionery and sweetmeats are highly poisonous in themselves; but they are used in infinitesimal proportions, and before any individual had taken enough of colouring matter to injure him, his digestion would probably have been seriously disturbed by the substance which they were employed to adorn.

Blackwell, 4891.

127. The employment of copper sulphate to colour peas and other vegetables has been carefully considered by us. It is highly undesirable that what is admittedly a poisonous substance should be used, even to the smallest extent, in connection with such food as may be consumed in considerable quantity. The public have got into their heads that vegetables ought to be green, and green they insist upon having them. Direct

proof that vegetables containing copper are injurious to the consumer is from the very nature of the case difficult to obtain, and we must admit that we have not succeeded in obtaining it. There is evidence pointing to the conclusion that the copper, when added to the vegetables, forms a compound which is not easily soluble in the human economy. There is, however, evidence of a contrary character, and it is not clear to us that the whole of the copper added becomes, or remains, insoluble under all conditions. Be this as it may, recent events have so incontestably demonstrated the serious and widespread mischief which may result from the consumption of food and drink, other than sweetmeats, containing even minimal quantities of poisonous metallic substances, that we are strongly of opinion that such poisonous substances should be rigorously excluded.

Cameron, 2556.
Appendix XXII.
Brierley, 3289.
Poore, 7371–72, 7400–2.
W. C. Williams, 5372–76.
Hope, 6930–32.

128. There is such a wide choice of colouring matters suitable for the dairy trade, that no inconvenience would arise from restricting it to the use of innocuous substances as these may be defined and permitted in the manner hereafter suggested. But the same reason which we have given for the prohibition of preservative in milk offered for sale, namely, the large quantity thereof which may be consumed by an individual, appears to render it highly undesirable that any colouring matter should be permitted in milk. There is this further consideration, that milk is sold as an absolutely raw, unmanufactured article, of which the purchaser is entitled to be aware of the natural colour, and to draw his own conclusions therefrom as to quality.

Table D., Appendix VIII.
Table O., Appendix VIII
Boseley, 1050.

129. In the butter trade and still more so in the cheese trade artificial colouring has long been established. Highly coloured goods find favour in some markets, uncoloured or faintly coloured goods in others. We have not found that in the interest of the consumer any interference is necessary with the customs of the trade in this respect.

130. In regard to margarine, we have to deal with a cheap and relatively inferior article invariably coloured to resemble a more costly and superior article, and probably the only means of protecting the public from imposition would be to prohibit the introduction of any colouring matter into margarine which shall cause it to resemble butter. Be the regulations as to the sale of margarine under declaration what they may, they cannot protect the customer who calls for bread and butter at a hotel or restaurant from being served with bread and margarine, and paying for it at the rate charged for the superior article. But as the margarine may be assumed to be a perfectly wholesome article of diet, it does not fall within the terms of our reference to make any recommendation upon a practice which is not attended with risk to the public health.

131. We wish to state as our opinion that the departmental machinery for controlling the preparation and conservation of food and drink in this country is not as complete as could be wished. The obvious fact has been referred to by several witnesses, that new methods of preserving and new preserving agents and colouring matters will continue to be introduced. We regard it as a matter of concern for the public health that the nature of such substances or processes should be critically examined and their effects upon the human economy, if possible, ascertained.

132. The importance of some such provision has been brought before the Committee by several witnesses. We would also draw attention to the fact that the Select Committee on Food Products Adulteration (*Parliamentary Paper*, 288 *of* 1896) felt this want, and that they suggested the formation of what they termed a *Court of Reference.*

Blyth, 3407-9, 3410.
Stevenson, 4851–53.
Brunton, 7437–38.

In their view—

> "An authority should be constituted who should act as a Court of Reference upon scientific and other questions arising under the Act, and who should be empowered at their discretion to prescribe standards and limits of the quality and purity of food."

Vol. III., 1896, p. xlii.

133. We agree that a Court of this nature would prove most useful with regard to the subject of food preservatives and colouring matters in food.

It should not be too large, but should embrace at least a chemist, a bacteriologist, a pharmacologist, a physician, a physiologist, and a representative of the Public Health Service.

The members of this Court should be nominated by the State, and it should be subject to total or partial reconstruction every five years, the members being eligible for re-appointment. The Court should be invested with all the powers necessary for the prosecution of its duties, which should be rigidly defined, and we consider it important that the Court should be in a position to obtain such information as it may require as to the methods of preparing foods and drinks.

134. Failing the creation of such a Court, we consider that the Local Government Board should possess, and should be called upon to exercise, such powers as would enable them to schedule by Order any preservative or colouring matter which, after such inquiry and experiments as the Department may deem fit, may be regarded as likely to prove dangerous to the public health.

135. Further, with a view to watching the future development of the several methods of food preservation and colouring Public Analysts throughout the country should be instructed to inform the Local Government Board of any new practices observed by them in their districts.

RECOMMENDATIONS.

136. Based upon the foregoing conclusions, we beg to make the following recommendations :—

(A.) That the use of formaldehyde or formalin, or preparations thereof, in foods or drinks be absolutely prohibited, and that salicylic acid be not used in a greater proportion than 1 gr. per pint in liquid food and 1 gr. per pound in solid food. Its presence in all cases to be declared.

(B.) That the use of any preservative or colouring matter whatever in milk offered for sale in the United Kingdom be constituted an offence under the Sale of Food and Drugs Acts.

(C.) That the only preservative which it shall be lawful to use in cream be boric acid or mixtures of boric acid and borax, and in amount not exceeding 0·25 per cent. expressed as boric acid. The amount of such preservative to be notified by a label upon the vessel.

(D.) That the only preservative permitted to be used in butter and margarine be boric acid or mixtures of boric acid and borax, to be used in proportions not exceeding 0·5 per cent. expressed as boric acid.

(E.) That in the case of all dietetic preparations intended for the use of invalids or infants chemical preservatives of all kinds be prohibited.

(F.) That the use of copper salts in the so-called greening of preserved foods be prohibited.

(G.) That means be provided either by the establishment of a separate Court of Reference or by the imposition of more direct obligation on the Local Government Board to exercise supervision over the use of preservatives and colouring matters in foods, and to prepare schedules of such as may be considered inimical to the public health.

137. We cannot conclude our Report without making grateful acknowledgment to professional gentlemen, traders, agriculturists, and others who have shown so much willingness to facilitate our protracted Inquiry by their evidence, and by laying before us, in several instances, the result of difficult and delicate experiments. We desire also to express to the Chemical Society our sense of their courtesy in placing at our disposal their Council Chamber in Burlington House for our meetings.

138. Lastly, we wish to acknowledge the help we have received from the unremitting attention to his duties and to our convenience of our Secretary, Mr. C. J. Huddart, of the Local Government Board, whose special training rendered him peculiarly competent to apply his faculties to the work of the Committee, and from whose willing assistance we have received constant advantage.

HERBERT MAXWELL, Chairman.

T. E. THORPE.

H. TIMBRELL BULSTRODE.

F. W. TUNNICLIFFE.

CHAS. J. HUDDART, Secretary.

THE USE OF COPPER SULPHATE IN THE GREENING OF PRESERVED VEGETABLES, Etc.

I agree with the above Report, except as to paragraph 127 and recommendation F. With regard to the question of the addition of copper sulphate to preserved vegetables and fruits for the purpose of rendering them permanently green I regret that I am not quite in agreement with my colleagues. I regard it as established that these substances, as well as many other articles of diet naturally contain copper, and that copper is constantly being introduced into food by the ordinary culinary processes, and further that although the copper is added in a soluble and absorbable form to the vegetables, it is not so present in them as consumed, being converted by them into a relatively insoluble and unabsorbable compound. I can conceive of no conditions under which the small quantity of copper present in the above form in properly preserved peas could be injurious to any consumer to whom the peas themselves would be harmless. In addition I can see, so far as concerns a possible injurious effect, no analogy between this compound of copper in green vegetables which are eaten by the ounce and a highly soluble salt of lead in water, or of arsenic in beer, both liquids drunk by the quart or gallon. It must be remembered also in this connection that in France an order was issued prohibiting the use of copper for the above purpose and that this order had subsequently to be rescinded. It also appears that in Germany, where the use of copper for the artificial greening of vegetables, etc., is prohibited, preserved vegetables containing copper are easily obtainable on the open market, apparently showing that the actual enforcement of the prohibition is attended with difficulty.

Recent research has distinctly taught us that, from the point of view of its nutritive value, great importance attaches to the appetising appearance of food, and in my opinion we should not without very definite reason arbitrarily prevent the gratification of the public taste for a perennial supply of green vegetables and thereby destroy if not an important at least a thriving industry.

I am, however, satisfied that often an unnecessarily large amount of copper is present in vegetables permanently coloured by means of it, and although in spite of diligent inquiry no injurious results have been known to have accrued even from these quantities, yet nevertheless only the necessary amount should be added. I should, therefore, recommend that the presence of copper in these preserved vegetables be in every case declared and that its amount be restricted to half a grain of metallic copper per pound.

F. W. TUNNICLIFFE.

LIST OF WITNESSES.

In Order of Hearing.

No.	Name.	Description.	Questions.	Page.
1	Kellitt, Mr. John	Representative of Grocers' Federation	1—75	1
2	Sandes, Captain T. W.	J. P.	76—125	3
3	Bennett, Mr. J. Wheeler	Representative of London Chamber of Commerce.	126—236	5
4	Dale, Mr. H.	President of Cork Butter Association	237—339	8
5	Shanahan, Mr. H.	Representative of Cork Butter Association.	340—488	11
6	Hudson, Mr. J.	Representative of Butter Association	489—555	15
7	Prossor, Mr. J. E.	Manager, Messrs. Rehoe, Donelly, and Packenham.	556—610	17
8	Trengrouse, Mr. H.	Representative of London Chamber of Commerce.	611—704	18
9	Lovell, Mr. J. Cary	Representative of Butter Association	705—815	21
10	Riley, Mr. James	Representative of Liverpool Chamber of Commerce.	816—854	26
11	Gregson, Mr. Charles E. L.	President of Liverpool Provision Trade Association.	855—933	27
12	Sinclair, Mr. S. Gibson	Representative of Liverpool Provision Trade Association.	934—947	30
13	Boseley, Mr. L. K.	Analyst to Messrs. Keiller and Son, Limited.	948—1166	30
14	Copeman, Mr. J. W.	Representative of London Chamber of Commerce.	1167—1306	37
15	Jones, Dr. J. Howard	Medical Officer of Health for Newport (Mon.)	1307—1411	43
16	Wild, Dr. R. B.	Assistant Lecturer on Materia Medica and Therapeutics, Owens College.	1412—1498	46
17	Clement, Mr. T.	Representative of Scottish Wholesale Provision Merchants' Association.	1499—1583	50
18	Davidson, Mr. William	Ditto ditto	1584—1634	52
19	Voelcker, Dr. J. A.	Representative of Royal Agricultural Society of England.	1635—1750 1817	54, 61
20	McFadyean, Professor J.	Principal of Royal Veterinary College	1751—1816	59
21	Walford, Dr. E.	Medical Officer of Health for Cardiff	1818—1931	62
22	Cripps, Mr. R. A.	Analyst	1932—1974	65
23	Vasey, Mr. S. A.	Representative of "The Lancet"	1975—2107	67
24	Williams, Dr. William	Representative of the Incorporated Society of Medical Officers of Health.	2108—2258	71
25	Handford, Dr. Henry	Representative of British Medical Association.	2259—2324	76
26	Hill, Dr. A.	Representative of the Incorporated Society of Medical Officers of Health.	2325—2522	78
27	Cameron, Dr. J. S.	Representative of British Medical Association.	2523—2600	84
28	Mann, Dr. J. Dixon	Professor of Forensic Medicine and Toxicology, Owens College.	2601—2633	88
29	Annett, Dr. H. E.	Demonstrator in Tropical Medicine and Pathology, University College Laboratory, Liverpool.	2634—2705	91
30	Boyce, Professor R.	Professor of Pathology, University College, Liverpool.	2706—2780	93
31	Bell, Dr. Robert	Representative of Scottish Wholesale Provision Trade Association.	2781—2848	96
32	McCracken, Mr. Robert	Manager, Dunragit United Creameries, Limited.	2849—3009	99
33	Dunn, Mr. C. J.	Chairman of Cork Butter Market Trust	3010—3061	102
34	Bond, Dr. Thomas	Consulting Surgeon to Westminster Hospital.	3062—3167	105
35	Brierley, Mr. James	Public Analyst for Southampton, &c.	3168—3294	108
36	Lowe, Mr. W. F.	Public Analyst for Chester, &c.	3295—3297	113
37	Robinson, Dr. M. Kent	Medical Officer of Health for East Kent Combined Sanitary Districts.	3298—3347	113
38	Blyth, Professor A. Wynter	Public Analyst for St. Marylebone, &c.	3348—3481	115
39	Bannister, Mr. R.	Late Deputy-Principal of Inland Revenue Branch of Government Laboratory.	3482—3678	120

LIST OF WITNESSES—In Order of Hearing—*continued.*

No.	Name.	Description.	Questions.	Page.
40	Rideal, Dr. S. - -	Doctor of Science - - - - -	3679—3782	126
41	Cassal, Major C. E. - -	Public Analyst for Kensington, &c. -	3783—3898	129
42	De Hailes, Mr. A. J. - -	Analyst to Dairy Trade Protection Society.	3899—4043	136
43	Foulerton, Mr. A. G. R. - -	Bacteriologist to Middlesex Hospital -	4044—4198	141
44	Faber, Mr. H. - - -	Commissioner of Danish Government -	4199—4359	145
45	Gilbey, Mr. A. - - -	Partner, Messrs. W. and A. Gilbey -	4360—4406	150
46	Smith, Mr. T. C. - - -	Representative of Central Chamber of Agriculture.	4407—4564	152
47	Long, Professor J. - - -	- - Ditto - - ditto - -	4565—4709	158
48	Fisher, Mr. W. W. - - -	Representative of Society of Public Analysts.	4710—4795	163
49	Stevenson, Dr. T. - - -	- - Ditto - - ditto - -	4796—4856	167
50	Blackwell, Mr. T. F. - -	Chairman, Messrs. Crosse & Blackwell -	4857—4922	170
51	Tubb-Thomas, Mr. J. - -	County Medical Officer of Health, Wiltshire.	4923—5069	171
52	Corfield, Professor W. H. -	Medical Officer of Health for St. George, Hanover Square.	5070—5144	176
53	Williams, Mr. W. C. - -	Public Analyst for Blackburn, &c. -	5145—5431	179
54	Kaye, Dr. J. R. - - -	County Medical Officer of Health, West Riding of Yorkshire.	5432—5561	187
55	Hehner, Mr. Otto - - -	Public Analyst for Derby, &c. - -	5562—5638	191
56	Richmond, Mr. H. D. - -	Analyst to Aylesbury Dairy Company, Limited.	5639—5765 5862—5865 5870—5871	194 200 200
57	Hattersley, Mr. I. A. - -	Managing Director of Aylesbury Dairy Company, Limited.	5766—5861 5866—5869 5872—5900	198 200 200
58	Dupré, Dr. A. - - -	Public Analyst for Westminster - -	5901—5947	201
59	Harris, Mr. J. M. - - -	Representative of Bacon Curers' Association.	5948—6041	203
60	Blaxall, Dr. F. R. - - -	Lecturer on Bacteriology, Westminster Hospital Medical School.	6042—6151	206
61	Cameron, Mr. H. C. - -	Produce Commissioner to New Zealand Government.	6152—6309	209
62	Gibson, Mr. R. - - -	Salesmaster, Public Creamery Market, Limerick.	6310—6404	215
63	Grünbaum, Dr. A. - - -	Lecturer on Chemical Physiology, University College, Liverpool.	6405—6490	220
64	Attfield, Professor J. - -	Late Professor of Practical Chemistry, Pharmaceutical Society of Great Britain.	6491—6573	223
65	Radcliffe-Cooke, Mr. C. W. -	Cider and Perry Merchant - - -	6574—6613	227
66	Lough, Mr. A. S. - - -	Managing Director, Cavan Creameries, Limited.	6614—6690	230
67	Hutchison, Dr. R. - - -	Representative of Great Ormond Street Hospital.	6691—6783	233
68	Still, Dr. G. F. - - -	- - Ditto - - ditto - -	6784—6820	236
69	Hope, Dr. E. - - - -	Medical Officer of Health for Liverpool -	6821—6932	238
70	Starling, Dr. E. H. - - -	Representative of Royal College of Surgeons of England.	6933—6991	243
71	Sorensen, Mr. Carl W. - -	Consulting Expert to Manchester Pure Milk Supply Company, Limited.	6992—7183	245
72	Anderson, Mr. A. R. - -	Surgeon to Nottingham General Hospital	7184—7215	250
73	Schidrowitz, Dr. P. - -	Doctor of Philosophy of Berne University.	7216—7261	251
74	Symons, Mr. Henry - -	Partner, Messrs. John Symons and Co. -	7262—7335	253
75	Poore, Dr. G. V. - - -	Representative of Royal College of Physicians of England.	7336—7472	256
76	Brunton, Sir T. Lauder - -	- - Ditto - - ditto - -	7423—7472	260
77	Womack, Mr. F. - - -	Representative of St. Bartholomew's Hospital.	7473—7524	262
78	Halliburton, Professor W. D. -	Representative of Royal College of Surgeons of England.	7525—7623	263

INDEX TO WITNESSES.

Number in previous List.	NAME.	Page.
72	Anderson, Mr. A. R.	250
29	Annett, Dr. H. E.	91
64	Attfield, Professor J.	223
39	Bannister, Mr. R.	120
31	Bell, Dr. Robert	96
3	Bennett, Mr. J. Wheeler	5
50	Blackwell, Mr. T. F.	170
60	Blaxall, Dr. F. R.	206
38	Blyth, Professor A. Wynter	115
34	Bond, Dr. Thomas	105
13	Boseley, Mr. L. K.	30
30	Boyce, Professor R.	93
35	Brierley, Mr. James	108
76	Brunton, Sir T. Lauder	260
61	Cameron, Mr. H. C.	209
27	Cameron, Dr. J. S.	84
41	Cassal, Major C. E.	129
17	Clement, Mr. T.	50
14	Copeman, Mr. J. W.	37
52	Corfield, Professor W. H.	176
22	Cripps, Mr. R. A.	65
4	Dale, Mr. H.	8
18	Davidson, Mr. William	52
42	De Hailes, Mr. A. J.	136
33	Dunn, Mr. C. J.	102
58	Dupré, Dr. A.	201
44	Faber, Mr. H.	145
48	Fisher, Mr. W. W.	163
43	Foulerton, Mr. A. G. R.	141
62	Gibson, Mr. R.	215
45	Gilbey, Mr. A.	150
11	Gregson, Mr. Charles E. L.	27
63	Grünbaum, Dr. A.	220
78	Halliburton, Professor W. D.	263
25	Handford, Dr. Henry	76
59	Harris, Mr. J. M.	203
57	Hattersley, Mr. I. A.	194
55	Hehner, Mr. Otto	191
26	Hill, Dr. A.	78
69	Hope, Dr. E.	238
6	Hudson, Mr. J.	15
67	Hutchison, Dr. R.	233
15	Jones, Dr. J. Howard	43
54	Kaye, Dr. J. R.	187
1	Kellitt, Mr. John	1
47	Long, Professor J.	158
66	Lough, Mr. A. S.	230
9	Lovell, Mr. J. Cary	21
36	Lowe, Mr. W. F.	113
32	McCracken, Mr. Robert	99
20	McFadyean, Professor J.	59
28	Mann, Dr. J. Dixon	88
75	Poore, Dr. G. V.	256
7	Prossor, Mr. J. E.	17
65	Radcliffe-Cooke, Mr. C. W.	227
56	Richmond, Mr. H. D.	194
40	Rideal, Dr. S.	126
10	Riley, Mr. James	26
37	Robinson, Dr. M. Kent	113
2	Sandes, Captain T. W.	3
73	Schidrowitz, Dr. P.	251
5	Shanahan, Mr. H.	11
12	Sinclair, Mr. S. Gibson	30
46	Smith, Mr. T. C.	152
71	Sorensen, Mr. Carl W.	245
70	Starling, Dr. E. H.	243
49	Stevenson, Dr. T.	167
68	Still, Dr. G. F.	236
74	Symons, Mr. Henry	253
8	Trengrouse, Mr. H.	18
51	Tubb-Thomas, Mr. J.	171
23	Vasey, Mr. S. A.	67
19	Voelcker, Dr. J. A.	54, 61
21	Walford, Dr. E.	62
16	Wild, Dr. R. B.	46
53	Williams, Mr. W. C.	179
24	Williams, Dr. William	71
77	Womack, Mr. F.	262

MINUTES OF EVIDENCE

TAKEN BEFORE THE

DEPARTMENTAL COMMITTEE

ON

PRESERVATIVES

AND

COLOURING MATTER IN FOOD

AT ST. STEPHEN'S HOUSE, WESTMINSTER, S.W.

AND AT

THE COUNCIL CHAMBER, CHEMICAL SOCIETY, BURLINGTON HOUSE W

FIRST DAY.

Tuesday, 14*th November*, 1899.

MEMBERS:

The Right Hon. Sir HERBERT MAXWELL, M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.	F. W. TUNNICLIFFE, Esq., M.D.
H. TIMBRELL BULSTRODE, Esq., M.D.	CHARLES J. HUDDART, Esq., *Secretary*.

Mr. JOHN KELLITT, called; and Examined.

Mr. J. Kellitt.

14 Nov. 1899.

1. (*Chairman.*) You appear, I believe, on behalf of the Grocers' Federation?—Yes, I do.

2. Is that a large body?—Yes, it is. It represents a great many grocers. There are about 13,000 members, and some of them, of course, have a great many shops. It therefore represents a very large body of the trade.

3. Then you are also connected with a company of provision merchants in Liverpool, I believe?—Yes, I am a director of Fowler Brothers, Limited.

4. Your experience has been a long one, has it not?—Yes, it has; about forty-seven years.

5. Both as a wholesale provision dealer and as a retail shopkeeper?—Yes; I was ten years in the wholesale trade and thirty-five years in the retail trade.

6. I believe you are prepared to give us some of your experience in regard to preservatives?—Yes.

7. Have you found any opposition to the use of borax?—No, none whatever.

8. Are you familiar with the substance?—Yes, I am.

9. Are you familiar with both borax and boracic acid?—I have always called it borax, and I have not myself used the term boracic acid.

10. Do you use pure borax?—I do not know the difference between borax and boracic acid, so I could not say which I use.

11. I am not a chemist, so I hope you will not ask me to define it. In short, you use a great deal of borax?—Borax is used in the preservation of bacon that is packed in boxes, and we also have used it in dusting the bacon when it has been hung up to dry in order to prevent the flies blowing it, and also to absorb the moisture. It dries quicker when it has been dusted.

12. You use it for the double purpose of a preservative and to absorb the moisture?—Yes, absorbing the moisture prevents it from going slimy.

13. Is it effective as a preservative?—I think so.

14. How long has that been going on?—I should think for about twenty to twenty-five years, to my knowledge, we have sold boraxed bacon.

15. In increasing quantities?—Yes. There is a better trade for it than we had under the old method of curing. The American bacon used to be very salty. You might steep it and do what you liked with it, but you could not make it mild. Formerly the American bacon used to be cured in America, and then packed in boxes with a large quantity of salt. So long as it remained in those boxes it was gradually becoming more salt, and when we took it out of the boxes and prepared it for sale we had to steep it for a long time to extract the salt; but do what we could, we could not make it mild. The consequence was that we had endless complaints about the bacon being salty, and that is not a condition that we have at all now. The bacon is cured now, and then the salt is washed off, and it is just dusted with borax, and sent over in that form, and the borax prevents it becoming slimy, and does away with the excessive saltiness that we formerly had in the bacon.

16. Is it still cured with salt and saltpetre?—Yes. I do not know that borax would cure it at all. I should not think so.

17. In your use of borax as a preservative and as a drying agent, does the meat become saturated with it?—I do not think so.

18. It does not penetrate the fat and muscle?—No, I do not think so. As a rule the bacon that is cured that way is steeped, and after it has been steeped it is thoroughly washed and dried, and then, of course, when the housewives prepare it for cooking they, as a rule, pare the edges off. So I should say there is very little or no borax in the bacon at all when it is consumed; at any rate, I should think it would be a very small quantity, if there was any at all. Of course, I have never known anything about that scientifically, but I should not think so.

19. Have you anything to state on the general question?—No. I can only say that my experience has been a long one, and it has been varied. I have seen bacon under all conditions, and I have no hesitation in saying that the conditions of to-day are better alike for the dealer and the consumer than they have ever been in my experience.

20. Have you any knowledge of the substitution of borax or other preservatives for salt and saltpetre in the

Mr. J. Kellitt.

14 Nov. 1899.

curing of the meat?—No, I have no knowledge of that at all. From what I do know of the process of curing—and I have been over the packing houses in Chicago—I do not know that it is used at all in the actual curing of the meat; it is used more in the preservation of the meat after it is cured.

21. (*Professor Thorpe.*) I suppose what you are telling us now is your experience of imported produce, and solely of imported produce?—It is principally imported produce. It is the American produce that I spoke about as being so salty. With regard to the Irish-cured bacon there used to be a large quantity of salt in what we call the pocket. They take the blade out of the shoulder, and that is what we call the pocket, and in the bacon which came over from Ireland this salt remained in the pocket a few days longer than was necessary to cure it. Consequently that portion of the bacon was made particularly salty. The Irish bacon does not come over in the same way at all now. There is no salt in the pocket, and the whole of the shoulder is considerably milder than it used to be, which is a very great improvement indeed; no one, unless they had had the experience, would believe there could be such an improvement. The effect on the shoulders is that formerly they were nearly unsaleable on account of their being so salty, but now they are mild and eatable by anybody, and very satisfactory in comparison.

22. You yourself do not use this borax?—No, I am not a curer.

23. You yourself do not dust at all, I mean?—Yes; in hanging it up we used to dust it, because it used to help to dry the bacon quicker—to absorb the moisture and to prevent the flies blowing it. We have used it always in summer.

24. What is it that you purchase in order to so use—you say you draw no distinction between boracic acid and borax?—The article that I used in my retail trade was what we call boron, which was a preparation of borax, I believe. That was the commercial name that they gave it. It seemed to me to be of a very dry nature, and it used to absorb the damp more so than the borax that we sold in the shop. I had a retail shop, and we sold borax, but it was more of a moist character than the boron; the boron was of a drier character, and absorbed the moisture quicker.

25. You do not know whether you are using borax or whether you are using boracic acid?—I have always called it borax. I have never heard of any difference, and I do not know what difference there is between borax and boracic acid, if there is any. Not being a scientific man, if you ask me, I should think that the acid, of course, was a liquid, but I do not know whether it is or not. The trade called it borax, and they never used the term boracic acid. I have never heard it used in the trade.

26. (*Dr. Bulstrode.*) You said just now in answer to the chairman that you had no knowledge of the treatment of hams by any other method than the one which you have described here, practically in packing and dusting with boracic acid. Have you heard that hams are treated in any other way with boracic acid, or have you any suspicion that they are ever treated in any other way?—No, I have no suspicion of that. Of course, I should not like to say that they might not be treated in any other way; but I have no knowledge of it. We know that a certain kind of hams are pickled in the States, but I have no knowledge as to the article that the pickle is made of; it may be salt and saltpetre, and there might be a preservative used, for anything I know, but I should not like to say. I do not think that in the dry curing of bacon there is any such thing used, and I do not know that it is used even in the pickled meats.

27. You have never heard that it is being used?—No.

28. You have no suspicion that it is being used?—No; I have not any suspicion at all.

29. Do you think that the method of treating hams with boracic acid has led to an increased sale of hams so treated?—I think so. I think we have had a better sale of bacon preserved by the borax as we call it; and indeed unless there had been an alteration in the method the sale would have been limited very much, as people would not eat the meat, it was so salty.

30. What would be the effect, do you think, of prohibiting the use of boracic acid, or preparations of borax in the treatment of ham?—I think it would be very serious indeed if we had to go back to the old salt cure, unless you could find some other remedy that was equally good.

31. How would it affect the trade, do you think?—The present generation would not eat the salty bacon that they formerly did.

32. Would they have to go without bacon altogether?—The trade would have to try and cure it in Ireland, and if they did it would not keep.

33. Are you sure that the sale of hams has really increased per head of the population compared with what it was in the time when ham was treated with salt alone?—I think there is a much larger trade done in hams and bacon than there was formerly in proportion to the inhabitants. I do not think there is a doubt about it.

34. Do you think you could establish that?—I could establish it as far as my own experience in my own trade goes—that is in proportion to the trade that I did, we will say, 30 or 40 years ago, and the trade that I have done more recently.

35. (*Professor Thorpe.*) How is that independent of the general increase in wage-earning, and in the general spending power of the community. Could you prove that the borax had directly any effect in increasing the sale?—I could only prove that the bacon has become more agreeable to the consumers; it has been more appreciated, and consequently they have used it more readily. That it has been much more satisfactory to the consumer there is no doubt at all in my mind.

36. (*Dr. Bulstrode.*) You do not think that the borax is absorbed at all by the ham?—I should not think so.

37. Then you would say that in the event of hams being analysed no borax would be found in them?—Do you mean before or after they are cooked?

38. Either before or afterwards. After they have been treated in the method that you have been telling us of here. You say the borax is not absorbed, therefore if this is all that takes place, and the borax is not absorbed, there will be no borax in the ham?—I should think there is very little under any circumstances; that would be my opinion. I may say that I have often wished that I could find out if there was anything of the kind as far as that is concerned.

39. (*Chairman.*) Had you any difficulty in keeping cured meat before you took to these modern preservatives; had you any perceptible loss in your stock?—We used to have a great deal more tainted bacon; that is, bacon not cured. The cure has been improved considerably. Of course, that is the result of long experience. We have not a tenth of the tainted bacon that we used to have, and if we had we could not get rid of it. It used to be sold. There used to be a market for the tainted bacon at one time, but it could not be sold now.

40. Did you have fly-blown bacon?—Yes, we used to have a constant loss in the summer time through the fly blows.

41. And you are exempt from that now?—Yes, we have comparatively none. After you have dusted the bacon with this boron in summer there does not seem any fly blow at all. It is very rare to see a piece fly-blown. It must have been a piece that there is a moist spot in, which the fly blows. The flies blow where it is moist. They will not blow in a dry place, that is my experience.

42. You have limited your evidence, so far, to the ham and bacon trade, but is not your firm also provision merchants?—Fowler Brothers, Limited, that I am a director of, are simply bacon and ham curers. Of course, I have had some experience of butter. Both as a wholesale provision merchant, and also as a retail distributor, I have had a long experience in butter.

43. Have you anything to tell us about that?—No; the people to-day would not use the salt butter that we sold 30 or 40 years ago; they would not look at it, and they will have milder butter. From what I have heard, and what I have found from my own experience, an excess of salt is just as injurious as the borax would be. I do not think that you could use an excess of borax but what it would destroy the flavour of the butter. Salt, of course, is a thing that you can take pinches of, and you think nothing about it, but you could not take a pinch of borax, because it would not be a pleasant-flavoured article.

44. Where do you get your butter from chiefly?—We have had a first-class family trade. We have got the bulk of our best butter from Denmark, and then the secondary qualities from Ireland.

45. (*Professor Thorpe.*) Does the Danish butter contain borax?—I have read not, but I do not know, because I have never heard. It is remarkably good butter, and

Mr. J. Kellitt.

14 Nov. 1899.

they seem to have a different system of making it to what we have here.

46. (*Chairman.*) Does Danish butter keep well?—It does.

47. Better than English butter?—Yes.

48. Of course, I do not want to ask you to tell us any of the secrets of your trade, but I should like to know this: You say you are not aware whether there are any preservatives used in the Danish butter?—No, I am not.

49. Are you aware of any preservatives other than salt in any of the butter that you have sold?—I have read in our trade journals that preservatives have been found in some of our Colonial butter, for instance, but that is a kind of butter that I have never bought.

50. I am talking of what is within your knowledge—of the butter that has passed through your hands?—I have no idea that there was anything of the kind used in it.

51. (*Dr. Tunnicliffe.*) You said just now that there used to be a market for tainted bacon, did you not?—Yes.

52. What do you mean by tainted bacon?—Bacon that had not exactly just taken the salt, or was mild. Of course, there is a market for it yet, but it is not the same market that we used to have. I can illustrate it in the case of grouse and things of that kind. Thirty or forty years since our forefathers would take grouse in such a condition that they did not want taking—they would walk with them if they only knew the way; but the present generation, I do not think, would take them on the same lines. That just illustrates what the present generation think about tainted bacon and hams. For instance, in my time behind the counter I have had people who have come and asked me if I had any tainted bacon, they would buy it in preference, and I have known them to buy it in preference to sweet, well-cured bacon.

53. By tainted bacon, do you mean bacon that has not taken the salt, and at the same time bacon that is more or less——?—More or less tainted; not sweet bacon.

54. The people used to ask for this in preference to the other bacon if they got it cheaper?—Of course, they would get it cheaper, because the shopkeeper would not be able to sell it at the higher price; but still they would have it for preference.

55. In preference apart from price?—Yes, I have known customers of that kind—customers of my own.

56. (*Dr. Bulstrode.*) About how long would the hams be treated in the way you describe by boracic powder or boron powder, or whatever you call it?—As a rule all the provisions to-day are sold, comparatively speaking, fresh. The trade, as a rule, do not like any stale provisions, and they will have their goods fresh. It is only here and there in cases where people have been overloaded with stock and they have not been able to shift them and the market has been against them, then, of course, that they have to hold it a bit longer. Still, as a rule, the goods are sold fresh.

57. Dealing with the question of hams from America, how long would they in the usual practice be kept in borax?—You might say from the time that they left the packing house, which would be the time that they would be packed, from three weeks to six weeks perhaps would be the general time. I should think the bulk of the provisions are consumed in six weeks.

58. When they get over here, as I understand, this is all washed off, is it not?—It is not washed off until it gets into the retailer's hands, because it is all in the boxes.

59. Why does it take six weeks to get from the packing house into the retailer's hands?—There is a fortnight from the packing house in Chicago, and three weeks nearly when we sometimes miss a boat, as it is a long way from Chicago. It is a fortnight or three weeks before it could get over here, in any case.

60. When it gets over here the powder is washed off when the retailer gets it?—Yes; as a rule he gets it out of the boxes and he washes the powder off at the commencement of the week, and he sells a great deal of it by the end of the week, as a rule.

61. (*Dr. Tunnicliffe.*) When is the borax put on the hams?—It is all done in the act of packing; it is just sprinkled; it is a kind of powder.

62. That remains on?—It remains on until it is washed off by the retailer.

63. How long does it remain on; you said just now about six weeks?—It is a matter of three weeks before it is landed in Liverpool, and then it may be two or three weeks before it reaches the distributor's hands.

64. Then it is washed off, and the bacon is cured?—The bacon is cured first; then that is washed off, and the bacon is hung up and dried. In winter it has nothing put on it because it is not wanted; but in summer, as a rule, when the flies blow the bacon, it is only here and there that people do not use the boron. Some of the more careless class of tradesmen do not put anything at all on the bacon; they do not even put the boron on; they do not use it, and many of them have never heard of it, I daresay. I have heard of it, and I have used it because I think it is a very good thing.

65. (*Chairman.*) What is the process with home bacon; do you deal much with home bacon?—I have only sold Irish and Danish bacon. In the Irish bacon, as I have told you, the shoulder portion used to come over very salty. Where they take the blade out there is a very large hole, and that used to be filled with the coarsest salt, the strongest kind of salt that they would use in the curing of bacon. By the time that that had been in a week longer than the bacon had taken to cure, of course, the shoulder part was particularly salty and very unsaleable. Now that is all avoided. The pockets are washed out when the curing is over, and I suppose they are dusted with this borax or something to prevent their getting slimy, and it comes to our hands just as it is put in at the slaughtery.

66. (*Professor Thorpe.*) Is that so with Danish bacon also?—Yes, I think so.

67. Is it treated in exactly the same way?—Yes, I think so.

68. The two sides are sprinkled in the same way?—The shoulder portion is. The sides do not want anything on for the short time. In Denmark it is shipped on the Thursday, and we get it in our stores on the Monday or the Tuesday. That does not want anything put on it; it is put in bales simply.

69. Then they do not use borax?—I should not think they use much, anyway, because it comes over very quickly.

70. (*Dr. Bulstrode.*) Do you unpack the Danish hams?—The hams are cured with the sides as a rule; it is all one long flitch.

71. Do you unpack the bacon coming from Denmark?—Yes.

72. Have you ever seen any boracic acid or anything like that in it?—No, I have not; I have never seen anything like a powder of any kind.

73. (*Professor Thorpe.*) Do you know any reason why the Irish cure their bacon this way and the Danes do not?—The Irish used to cure it that way many years ago, going twenty or thirty years.

74. Why do they use boracic acid or borax or boron?—I understand they have put boron on to prevent it going slimy.

75. Why should the Irish do it for the English market if the Danes do not?—I cannot tell you. The Irish have not been so prompt in adopting the most improved methods as some of the Danes have; I am sorry to say they have not been prompt at all.

Captain Thomas William Sandes, called; and Examined.

Capt. T. W. Sandes.

76. (*Chairman.*) I think you are a Justice of the Peace for County Kerry?—Yes.

77. You have had some experience in working a creamery for the benefit of your tenants?—Yes, I started one in 1885. It was one of the first started, and it was not exactly a creamery then. A tenant used to send in some cream, and we used to churn it. We had not a separator in those days. I got a separator afterwards, and I worked it then up till 1896, when we amalgamated with the two adjoining co-operative creameries.

78. What do you make chiefly—butter?—Altogether butter.

79. How did you send your butter to market; in what state, I mean?—I used generally to send it saltless. What

Capt. T. W. Sandes.

14 Nov. 1899.

we call saltless butter is butter cured with 1lb. of preservative to 112lbs. of butter. Then the mild salted butter was cured with 1lb. of preservative, mixed with 3lbs. of salt to every 112lbs. of butter.

80. Has the preservative taken the place of salt?—Nearly altogether. All our heavy salted Irish butter used to go to the English people in the manufacturing districts, but now that saltless butter has come in they will not touch the heavy salted butter.

81. What was the preservative?—Boracic acid.

82. Pure?—I believe there was some blend with other acids, but that I do not know.

83. You never had it analysed?—No.

84. Is there still a market for salt butter?—Yes, for the very mild cured butter, you know. The heavy salted butters have from six to seven per cent. of salt in them; that is the ordinary Irish farm butter, as we call it.

85. What I do not understand is why you use a preservative only in one kind of butter, and mix it with salt in another kind?—It is just as some people might like to take their soup without salt in it, and some people would like some salt in it. They like the flavour of the salt.

86. They do, do they?—Yes, in a mild form, you know, not in the heavy form. It is very mild—3lbs. of salt to 112lbs. of butter; you would just detect the flavour of the salt, not more.

87. Have you ever heard any complaints of the effect of the preservative?—No. I may mention that I used to send this butter to a friend of mine in England, who used to get 10lbs. a week by post. I suggested on the reduction in the rates of the Parcels Post, as 1s. 6d. for every 10lbs. of butter came very hard, that she should take a 56lbs. keg, and she should write back how she liked it, without any salt in it. She wrote back, and said: "I do not think it would possibly keep." I said: "If it does not keep for a month you can return it to me, and I will allow you for any of the butter that has gone bad." Then she wrote in a month's time, asking me to send another keg to her, and said that the last of the keg of butter that I sent was just as good as the first.

88. Then, taking your creamery as a sample of the Irish butter trade, it looks as if the whole system had been revolutionised?—Altogether.

89. And that it would not be possible, I suppose, to go back to the use of salt?—No, I do not think so; I think it would be a very backward step.

90. What has been the effect on prices?—We used to get from 10s. to £1 over the Cork market for heavy salted butter.

91. I would like to get this clearly on the Notes, which I do not think it will be at present. Could you supply us with the average prices when you first began your creamery, or in the early years of it before you used preservatives?—When I first began my creamery I did not use the preservatives; they were not thought of when first I began. Even then the prices we used to get showed a great difference, because the creameries before were so very scarce, and mine was almost one of the first creameries in Ireland.

92. That would be, I suppose, because the butter was prepared with greater care than the ordinary butter in the Cork market?—Yes; in fact the people got very careless in Ireland about the preparation, and that is how we lost our good name.

93. What I want to get at is whether the substitution of these modern preservatives for salt has affected the average prices which you obtained for your butter?—I do not think the people now would touch it; they say not, and all merchants say that.

94. Pardon me; are you getting the same per lb. just now for your butter as you did before you used boracic acid as a preservative, or are you getting more or less?—I think the price is about the same. All saltless butter on the market fetches from 2s. to 4s. a cwt. more than butter with salt in the present day. It must be the best of butter to make it saltless; the salt will, more or less, cover a little of the sins; but saltless butter must be without fault.

95. (*Dr. Bulstrode.*) Could you tell us the exact method of adding the preservatives which you know are used?—We have a little sieve, and then, as the butter goes round the butter table the woman works it up with what they call hands, by little pats, and then she just shakes it over, then rolls it up again; then it goes under the roller, and it is squeezed out quite flat, and then the preservative is shaken all over again through this sieve; then she collects it up with those wooden hands, and then it goes under the roller again, and it is flattened out.

96. It is intimately mixed up with the butter, then?—Yes, it is very evenly mixed up; it must be.

97. How is the preservative measured?—We weigh it in a scale; we are most exact.

98. Where do you get this preservative?—From Laird and Co., chemists, in Limerick.

99. The proportions, then, are the proportions of this preservative you are now speaking of?—Yes.

100. It is one preservative?—Yes.

101. Have you ever used any other preservative except this?—No, I have never used any other. Mr. Gibson, who has had great experience, recommended this especially.

102. (*Professor Thorpe.*) What is the trade name?—I do not know that it has any; boracic acid I used to call it.

103. (*Chairman.*) Your own creamery, I understand, has been absorbed in a larger business?—Yes, in two co-operative ones. There was one on each side of me, and we thought it better to withdraw mine, as they were too near.

104. (*Dr. Bulstrode.*) Do you always add the same amount of boracic acid, both in summer and in winter?—Yes.

105. Do you think it is necessary?—We make very little saltless butter in winter, because, as I said, it must be of the very first quality. Of course, with cattle not fed on grass, but stall fed, as you may say, the winter butter cannot be so good as the grass butter.

106. How long is it necessary for the purpose of your trade for the butter to keep—I am speaking of this butter especially?—I suppose some of it, by the time it gets over to England and it is marketed, must be kept a month very often.

107. A month?—Yes, passing through one hand and another, by the time it gets over to England, to the wholesale man there and then to the retailer; and then the retailer would have it on his counter for some time. The butter merchants in Limerick told me that their Association made an experiment. They made a large churning of butter, about 112lbs., and divided it into four equal lots. No. 1 they cured with 1 per cent. of preservative; No. 2 they cured with 1 per cent. of preservative and 3 per cent. of salt; No. 3 with 3 per cent. of salt; and No. 4 was heavy salted—that is, it had 6 per cent. of salt. They packed it all in exactly the same boxes, and stored it up for nine months. At the end of the nine months Nos. 1 and 2 were good and eatable, and Nos. 3 and 4 were uneatable and rancid.

108. What preservative was that?—It was the same that I used; we all use that in the south of Ireland—boracic acid.

109. (*Dr. Tunnicliffe.*) I did not quite understand what you said about the last two samples. Was there a preservative used with the salt in them?—No, they had no preservative. One was what we call "heavy" salted, and even at the end of nine months was bad and uneatable.

110. At the end of nine months?—Yes, and the other was tainted, but the preservative butter was eatable.

111. The maximum time required for keeping the butter would be at the very most how long, for instance?—It depends, I suppose, upon the man who buys it and the number of customers he has. A man with a large number of customers would get rid of it very soon, and a man with a small number of customers might be very long in getting rid of it.

112. It would hardly be nine months, I mean?—Hardly; this was only an extraordinary thing just for their own satisfaction.

113. (*Professor Thorpe.*) You make your butter exclusively for the English market, I gather?—Yes, altogether.

114. Have you any knowledge of the mode of manufacture of butter in other places than Ireland?—No.

115. You are not familiar, for example, with the methods in Denmark?—We copy them—what I have read of them.

116. You copy them?—Yes, we copy them as much as

Capt. T. W. Sandes.

14 Nov. 1899.

we can, and we have had instructors from Denmark that have come through Mr. Horace Plunkett's Association. He sent instructors round.

117. Are you aware whether they use these preservatives in Denmark?—I suppose so—I am sure they do.

118. You think they do?—I know their butter would never stand—it would never come into the market. Butter will go bad in hot weather in two days; you cannot keep the aroma; the aroma of it is a most volatile thing, and it evaporates.

119. You do not know that it is a penal offence in Denmark to use preservatives with butter?—It might be, but I am afraid they wink at it.

120. (*Dr. Bulstrode.*) Did this instructor who was sent over from Denmark teach you to use boracic acid?—No, they do not go into that, but I think the instructors that come down from Glasnevin do it; in fact, you must use it with saltless butter—it would not last; it would be rotten in a week in the hot weather.

121. (*Dr. Tunnicliffe.*) It would not matter how the butter was prepared?—No; look at milk itself. If you cannot keep it in a cool place how quickly it goes sour. Butter will go equally sour.

122. (*Professor Thorpe.*) May I ask how you have gained your information as to the effect of boracic acid?—Mr. Gibson wrote to me; he is our sale master for the Creameries Associations in the south of Ireland. He said that he found it was impossible to dispose of the butter unless we used boracic acid or a preservative, and he recommended me this preservative then. He is our agent at Limerick; he sells for nearly all the creameries in the south of Ireland.

123. (*Chairman.*) How many cows supplied your creamery?—About a thousand; I turned out nearly a ton of butter a week.

124. (*Dr. Bulstrode.*) Do you think that boracic acid is ever added to the milk which goes to your creamery before it reaches the creamery?—It would not be worth their while. It comes hot from the cow; we separate it morning and evening, you know.

125. Do you take all they can give you?—Yes; the farthest distance anyone in the country would come is three miles. That is why I amalgamated it with the other creameries, because we were rather too close together. What was laid down is that the range is three miles, and that the creamery is in the centre, and then there are other ranges of three miles, and so the farmers send their milk straight. Very often a great number milk the cows in the field, and they do not house them.

Mr. J. Wheeler Bennett, called; and Examined.

Mr. J. W. Bennett.

126. (*Chairman.*) I believe you appear on behalf of the London Chamber of Commerce?—Yes.

127. You have been acquainted yourself with the provision trade for a number of years, I understand?—About thirty-five.

128. Can you speak to the change which has taken place in the use of preservatives during that time?—For the past twenty years we have adopted a slight sprinkling of borax on all products shipped from Canada. The preparation or the preservative is not used in any way in the cure, but when the product is cured a slight sprinkle of borax is put over the surface. That is shipped to this country, and when here the product is taken out of the boxes, washed out, scrubbed back and front—that is, the skin side and the flesh side; it is then drained for about twelve hours, and then it goes through the process of smoking; so that whatever is put on the surface of the product is washed off and scrubbed off, and then it comes out practically free from any borax whatever.

129. Is it dry borax that is put on?—Yes, a slight sprinkle of it; about four ounces to a side of 56lbs. It is not used in any way in the cure or in the process. We have been doing that for something like twenty years.

130. Do you think any appreciable quantity of that gets into the meat?—No. As I tell you, directly it comes to this country it is taken out of the boxes and put into tanks, sometimes of lukewarm water, and sometimes of cold water, and after being scrubbed it is thoroughly drained and smoked under a fire composed of fir dust and oak wood, and dried out. I represent the largest curing house in the British Empire, and that is our system adopted with the Canadians during the past 20 years. Prior to that, of course, the trade was infinitesimal compared with what it is now. I have here a certified return from the High Commissioner's Office, showing the great increase in the trade during the past ten years. It began in 1889, when it represented something like 300 000 dollars, and in 1898 it stands at 8.000,000 dollars. That is the value of the product shipped to this country, and that shows the increase in ten years.

131. Do you deal with home bacon at all?—Only in a very small degree.

132. Why is it small?—It is not popular. Where we should sell 100 sides of English bacon we should sell, perhaps, 3,000 or 4,000 sides of Canadian bacon.

133. Is the preservative applied in the same way to the English bacon?—I do not think so; I am not aware that it is so, but I have heard it is so at times.

134. But you have seen the English and Irish products come in?—Yes.

135. Have you noticed the borax in the same way upon them?—No.

136. You have not?—No.

137. Then do they use more salt and saltpetre in curing them?—It is firmer in the cure, harsher in the cure to what the Canadian is.

138. Have you come to any opinion about the effect of the use of borax or boracic acid—I do not think you draw any distinction between the two?—No. We simply use borax, and we think it is a most useful commodity. We have proved it over and over again. I myself have been eating it for the past 20 years.

139. You look all right I am glad to say?—Thank you.

140. Of course if it does not get into the meat, and most of it stays outside, you think that practically the consumer takes very little of it?—Only in the very slightest degree does he take it. I may say, speaking after trials, that out of the four ounces sprinkled upon a side, something like 80 per cent. in my opinion, is lost, having been washed away in the water.

141. (*Professor Thorpe.*) Then that would mean that one ounce was left in?—Probably that.

142. One ounce of borax was left in?—Yes, in 56lbs. I do not give you chapter and verse for that, but that is what I think. Of course, in summer time your view may be right, but in the winter time there is absolutely none, I think, left in; I think it is all washed off then, because the pores are dried up, and it is almost impossible for the bacon to absorb anything at all.

143. Do you draw any distinction between boracic acid and borax; is it actual borax you are using?—We sprinkle the powder of borax only.

144. Not boracic acid?—No, we never touch that.

145. (*Dr. Bulstrode.*) How do you account for this mild character in the hams with the treatment to which the hams are subjected with boracic acid?—I do not quite understand your question.

146. I think your position is that since the hams have been treated in the way you told us with borax they are less salty than they used to be?—Yes, and the increase in the trade is enormous. I have given you something like the figures.

147. How do you account for that; how do you explain that this borax put upon the surface of the ham should modify it to the extent which apparently it does?—There is a certain period of cure when the bacon has arrived at a state of perfection; if it were allowed to remain without borax the process of cure would go on, and the bacon would become salter and salter, until it would be absolutely useless on the English market. The process of cure is absolutely stopped by the application of this slight sprinkle of borax. It is preserved in the state in which it is cured on the other side; the process of cure is arrested, that is, the salt cure is arrested by the application of this borax.

148. And you do not think any appreciable amount of this borax is absorbed into the ham?—I am certain there is not. It would be a matter of taste; you would taste it at once in the product.

Mr. J. W. Bennett.

14 Nov. 1899.

149. Would you?—You would if any appreciable amount were absorbed in the ham, or in the bacon either.

150. Take butter, for instance, where a considerable amount of borax is used, it is very hard to detect it by taste, is it not?—The quantity used in the process of washing butter, or in preserving butter, is infinitesimal. I have had lots of experience of Australian butter and French butter.

151. Have you ever heard that in other parts exclusive of these which you are referring to, the hams are treated with preparations of borax in any other way than the one you have told us?—No.

152. Suppose on testing hams a considerable amount of borax were discovered in the ham deep in the meat, what would be your explanation of it?—My view would be that a very large quantity of borax was applied, and that the hams had been retained in their original state in the boxes for a considerable period of time.

153. Do you think that if the ham is packed up, as you told us, for long, that it might absorb some?—Yes, to some extent it would.

154. How long do you think, as a rule, the hams are kept in the borax?—A very short space of time. Directly they come to this country they are taken out of the boxes, and washed out by the process I have just mentioned to the Chairman.

155. Do you think that in cases where borax is found they have been too long packed; would that be your experience?—Yes, they have been delayed in transit, or something of that kind.

156. What do you think would be the effect upon the trade of prohibiting the treatment of hams by borax and by this method?—The whole trade would come to an end; we could not carry it on. This gigantic trade that has increased by leaps and bounds from Canada in the last twenty years would come to an end, because if we were to prepare the product as we used, prior to twenty years ago, the trade would be absolutely useless to this country.

157. Do you mean that if hams were not treated in this manner they could not be introduced from our colonies, we will say, into England?—They could not. I am absolutely clear upon that. We have tested it, and tried it over and over again.

158. Then you are convinced that the prohibition of preparations of borax in the treatment of ham would absolutely kill the colonial trade?—I am certain it would, and so it would the Australian butter trade, and so it would the American trade. Any trade connected with the provision trade in regard to a mild-cured product would absolutely come to an end. I am as clear about that as I am about anything in this world, simply because we have proved it by experiment over and over again. We have tried to bring a Canadian produce without borax.

159. Tried, how?—As we had to treat it twenty years ago, only much milder. We could bring it here as we did twenty years ago, but the trade would come to an end; it would be absolutely useless on the English market.

160. (*Chairman.*) Because of the change in taste?—Yes, the cure would be so harsh and so disagreeable to the taste that it would come to an end; it would fall by its own weight.

161. (*Dr. Bulstrode.*) Broadly speaking, what proportion of bacon and ham in this country is home produce in relation to the imported produce?—A very small quantity indeed——

162. Is home produce?—Yes, a very small quantity.

163. Then the effect of the prohibition, broadly speaking, would be that a very large number of people who are eating ham and bacon now would have to live without it?—It would raise the price somewhere in the region of 70*s*. or 80*s*. per hundredweight, whereas at the present time it can be bought at from 44*s*. to 46*s*.

164. Quite apart from the question of price, the people could not procure it?—No, they could not. You would deprive millions of people of a product which they now enjoy by a prohibitory price.

165. (*Professor Thorpe.*) That is not very clear; how is the price to be raised to this relatively high extent?—Because of the immense imports into this country which keep the price of what you may call the home product down.

166. I presume some imported stuff would still come in; the country itself cannot supply anything like the demand?—That is exactly my point; it could not come in if the present system were interfered with.

167. Did I gather from you that no imported bacon would be possible unless borax was used?—Not a bit of it.

168. (*Dr. Bulstrode.*) Not from nearer than Canada?—No.

169. Not from the Continent?—No, unless handled for immediate consumption.

170. (*Chairman.*) No imported mild bacon?—No imported mild bacon.

171. (*Professor Thorpe.*) You might know of other methods?—There is no other method; we have experimented, and we have tried every known source. We have studied chemistry, and have had men of culture in that direction to our assistance, and it has been an absolute failure. There is nothing known at the present time better than a slight sprinkling of borax to produce a mild-cured article suitable to the requirements of this country.

172. (*Chairman.*) Assuming it to be harmless, you do not wish for anything better?—Nothing at all better. We say that for twenty years not only have we produced an article which pleases the people, and satisfies the people, but we think the health of the people is better now than it was twenty years ago.

173. (*Dr. Bulstrode.*) Could you tell us roughly at what date the importation of foreign bacon and hams into this country began?—Into this country, about forty or fifty years ago from America, but it was such crude stuff that the size of the imports was infinitesimal compared with what they are now, and it was done with a very low range of product, so that no one cared about it. When we commenced, as I tell you, twenty years ago, to adopt this system, the imports went up by leaps and bounds. I should be very pleased to furnish you with what I have secured from the High Commissioner of Canada, showing you a verified account of the vast improvement in the size of the imports.

174. Is that not to be accounted for in any way by the increase of population or the diminution of the home produce?—No, but simply by perfection of quality. There has been a steadily improving product all the time finding favour with the masses of the people of this country.

175. Then as I understand it, if boracic acid were prohibited you think most people would either have to consume the old salted hams or go without?—That is right.

176. They could be produced still?—Yes, they could be produced.

177. I mean there would be no ham famine in the country, so to speak?—They would not be appreciated; you could not eat them.

178. There would be nothing else—there would be no question of competition?—There is no doubt about it.

179. (*Dr. Tunnicliffe.*) At what time exactly does your knowledge—beginning with the pig—of the manufacture of bacon begin?—That is, in any process whatever?

180. Yes; starting with the pig—what happens before it comes to this country, do you know that?—I do know it.

181. Would you mind telling us?—I have been in Canada.

182. That is why I asked you?—And I have had practical experience in Ireland for many years also. The pig is killed and put into chilled chambers—cold air chambers.

183. It is bled in the usual way and put into cold air chambers?—Yes; the animal heat is exhausted, and then it is passed down into a temperature of something like 44 degrees. when salt is applied for something like 10 to 12 days. The process, then, is perfected as far as the bacon-curing goes. It is then taken out and the salt all brushed off.

184. Is the salt applied in solution—I mean is the bacon dipped in a solution of salt?—No, it is sprinkled with dry salt.

185. In the first instance?—Yes. Then it is wiped dry with wrappers, and then this slight sprinkle of borax is put on it.

186. Outside the wrappers?—No, on the face of the bacon.

187. Then the wrappers put on again?—No; then it is packed in boxes, about twelve sides to each box, and shipped to this country. Directly it comes here these sides are taken out, they are put into large vats of lukewarm water, or cold water, soaked, and then with brushes it is brushed off both back and front, and it is

Mr. J. W. Bennett.

14 Nov. 1899.

hung up to drain for about twelve hours. It is then put in under a fire, which runs up to something like 100 degrees of heat, and gradually worked down and down under smoke until it comes out the colour that you see it in the shops in this country. When it arrives in this country it is in a perfectly green state.

188. (*Chairman.*) Do you remember in the old times whether you had any difficulty with putrefaction or flies?—In the old times we used to have tons and tons of taint coming into this country—that is, decomposition had set in—and the losses were colossal. I remember distinctly in this large business that I am connected with—and as I tell you the William Davies Company that I represent are the largest curers in the British Empire—that for three or four years we had, steadily, tons and tons of taint, and that it was most difficult to combat and find out what was the cause. That was prior to the use of this preservative. Directly we commenced with this it was a case of Eureka; we had found it out, and taint is an unknown quantity, practically, now. If there should be any taint it is absolutely due to the neglect of the man in the cellar.

189. (*Dr. Tunnicliffe.*) You put more salt though in those times?—Yes.

190. And still got the taint?—Yes.

191. What did you do with the tainted bacon, so-called—was there a market for tainted bacon?—In those days there was a market for it, with a loss of about 50 per cent. from the original value; but to-day the sanitary inspector is called in, and it is buried. We get a certificate if anything like that should occur from any neglect at all. There is no market now for it, or practically none.

192. (*Professor Thorpe.*) Are you aware whether solutions of borax are injected into the carcase?—I am certain they are not. I speak from practical experience as a bacon-curer. You would get the taste of it there at once; you never could get it out.

193. (*Dr. Bulstrode.*) May we have the figures which you have promised us?—Yes. (*The witness handed in table of Canadian exports. See App. No. 19.*)

194. (*Chairman.*) You have spoken of the butter trade. Have you done much in that line?—We have had very large transactions with Australian butter and also French butter.

195. Are those treated with preservatives?—Yes.

196. Do you know anything about Danish butter?—I do not know anything about Danish butter.

197. Is the Australian butter trade a large and increasing trade also?—Yes, it is increasing by leaps and bounds; you can see that by the imports.

198. Does that hinge upon borax also?—It is washed with a solution of borax.

199. Does that trade depend upon the use of these preservatives?—It does, because it keeps the butter so much better. There is no such thing as rancid butter since we have adopted that system that I spoke of, namely, washing it very slightly with a solution of borax. The same applies to France. For twenty years we have been agents for very large French butter shippers. Every bit of that butter is washed in a solution of borax. The butter comes in crocks of 56lbs. each. The butter is put into a cloth soaked in this solution of borax, and then put into a wicker basket, or an earthenware crock, and shipped to this country. When we used not to use that process the butter would get rank in forty-eight hours. I have known the butter to arive in twenty-four hours rank in hot weather. There is no such thing known now.

200. Some manufacturers mix the borax with the butter, do they not?—Not that I am aware of. I have never seen that done.

201. The last witness described how the Irish manufacturer mixes it well into the butter?—That is not the system we adopt. We adopt the system, as I tell you, of covering it with a cloth dipped in a solution of borax.

202. And that is quite effective?—It is very effective.

203. With the butter from the Antipodes?—Yes, and from France also.

204. In that case a sample taken from the middle of the crock ought to contain no borax?—It ought to contain none whatever.

205. (*Professor Thorpe.*) Do you know, of your own knowledge, that it does not?—I am certain that the butter I speak of does not when the borax is applied by the process that I speak of, namely, covering it merely with a cloth dipped in the solution.

206. (*Chairman.*) I see that lard bulks largely in this return which you have handed in; is that dealt with in the same way by external washes?—No. Lard is boiled directly it is taken from the hog; it is at once thrown into vats, and all processes of decomposition are lost by the boiling process. Lard will keep almost any length of time, if it be properly boiled.

207. You do not want a preservative there?—No. I do not believe there is the slightest particle of preservative in any lard that is properly boiled.

208. (*Dr. Bulstrode.*) Do you give instructions to those who supply you with Australian and with French butter that no preservatives are to be used in the manufacture of the butter, only in the method of which you have told us?—We advise them to do that.

209. You do not know whether they may not make up the butter, also, with boracic acid, as we have been told is the custom?—In France I do know it, but in Australia I do not. I have never been in the Australian butter-making factories; I have been in the butter-making factories in France often.

210. You do not stipulate any conditions with regard to butter which comes to you from France?—No.

211. Suppose the butter contained a considerable amount of boracic acid in it, you would not reject it, would you?—No.

212. You do not make it a condition of purchase?—No. But every such article would reject itself, because it would be distasteful to the community who buy it; you can taste it at once. Directly you put your knife down into the centre of a crock of butter you would get the aroma, the flavour, of the borax at once.

213. Do you think the lay people could do that?—I am sure they could.

214. About how much do you think would produce that taste at all, or smell?—I could not tell you. I am not scientific enough to know what process would go on upon any quantity put into the butter, but we advise all our people merely to dip the cloth in a solution of borax and to cover the butter, which is ample, as we have proved over and over again.

215. Could you supply the Committee with a specimen of butter which has been made distasteful by the presence of borax?—I could not; I never saw one.

216. How do you know, then, that it could be detected?—I am certain it could, because borax, directly you come in contact with it, shows its presence at once.

217. (*Professor Thorpe.*) How?—By an aroma, a certain flavour that there is in it, if the quantity that you indicate were put into the butter.

218. (*Dr. Bulstrode.*) How much have I indicated? I did not know that I had indicated any amount?—It seemed clear to my mind that borax mixed up with butter would very soon develop itself. I never heard of it before, and I never saw any butter that showed borax in that degree. You would want a lot of borax mixed up with butter to make itself felt or smelt.

219. Are you familiar with the methods of preparing butter in Ireland?—Yes, I have been in Ireland often.

220. As far as you are aware, borax is not used as a preservative for Irish butter except in the way you mention?—That is so.

221. (*Professor Thorpe.*) Are you not familiar with the fact that prosecutions have taken place under the Food and Drugs Act in the case of butter which is alleged to contain such an amount of borax that the article is to the prejudice of the consumer merely as weight?—No.

222. And yet that consumer has not been able to taste it?—No.

223. You are not aware of that fact?—No, and I have been watching them, too, pretty closely.

224. There was a very notable case not long ago in South Wales, where this very question was tested?—I remember the case well, and I remember reading Dr. Bond's evidence in that very case.

225. Then you are aware of the fact?—Yes, but it was not a question of borax. That was the trial on account of American hams.

226. No, pardon me; I happen to know, because the matter was referred to me?—Perhaps I lost sight of it.

Mr. J. W. Bennett.

14 Nov. 1899.

I thought you were referring to a case tried on account of borax.

227. (*Dr. Bulstrode.*) I think there was also a ham case?—Yes, there was.

228. (*Professor Thorpe.*) We have had ham cases, too. That was a sample of Irish butter in which the amount of borax was excessive?—I should think then it produced such a flavour that it was easily discernible to the public taste.

229. No, that was not the case?—I have never seen anything like that, and I have lived for ten years in Ireland. Of course, if borax were present in large quantities in any product, anyone could discern it.

230. (*Dr. Tunnicliffe.*) He could taste it?—Yes.

231. You could do it yourself?—I am certain of it.

232. (*Chairman.*) Can you tell us when the use of borax as a preservative became general in American imported meat?—About twenty years ago, as near as I can tell you. I have been thinking, and I can go back very clearly about twenty years.

233. Can you account for the very marked increase imported bacon and ham from 690,210dols. in 1891 1,225,482dols. in 1892; and the nearly correspond sudden rise in the following year in pork from a value 357dols. in 1892, to 46,689dols. in 1893?—And so on, creasing year after year.

234. What I have remarked is the enormous rise that one year?—Just along that period Canadian produ came into great notoriety in this country, and to use American phrase, the people "caught on" to the p duct, and that stimulated the great production whi has gone on ever since.

235. It is a sudden jump?—You will see that the ju is marvellous during the past ten years.

236. The progressive jumps are very great, but t single jump exceeds them all?—The Canadian farmer paid a better price for his product along that period th he was ever paid before, and the product pleased t country so much that he got a rare encouragement, whi has continued up to the present time.

SECOND DAY.

Wednesday, 15*th November* 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary.*

Mr. H. Dale.

Mr. HENRY DALE, called; and Examined.

15 Nov. 1899.

237. (*Chairman.*) You are an Alderman of Cork, I understand?—Yes.

238. And you represent the firm of Messrs. Richard Clear and Co., Limited?—Yes. I also represent the Cork Butter Exporters' Association, of which I am president.

239. Have you had a long experience of the trade?—I have had a long experience extending over some forty years or thereabouts.

240. It has undergone considerable changes in that time, has it not?—It has undergone very considerable changes.

241. Can you describe to the Committee generally what is the nature of these changes?—Generally speaking, the taste for heavily salted butter has changed very much, and people now want the butter without so much salt; and also they desire more uniformity than there was formerly in the butter.

242. In former years they might have desired those qualities, but they could not obtain them?—Quite so, they could not obtain them.

243. What has the manufacturer substituted for the use of the salt in butter?—The use of preservatives under various names, but the base of all these preservatives is boracic acid.

244. How is that applied?—It is mixed with the butter at the time that it is being made and packed. A preservative of a good quality is very soluble, and blends completely with the butter.

245. You say that greater uniformity is now expected; how is that obtained?—It is obtained by the manufacturing of butter in larger quantities than used formerly to be the case when each farmer manufactured his own butter.

246. Through the creameries?—Nowadays factories on the Normandy style and creameries on the Danish style have become general in Ireland.

247. Are you aware that the use of preservatives in Denmark is prohibited by law?—Yes, I am.

248. Is there any reason why they should not be discontinued in this country?—It would interfere materially with the keeping qualities of the butter, and would necessitate using more salt. Irish butter, which formerly used to be heavily salted for the purpose of keeping, no with the lighter salting would not keep beyond a ver short time if preservatives were not used.

249. Why does Irish butter differ from Danish butte now?—I do not know that it differs materially, but as matter of fact the Danish butter that comes on to th market goes into consumption more quickly. Partly b the necessities of their trade they have got into the hab of using it more quickly, I think.

250. In the butters which you yourself export, wha proportion of preservative do you use?—About three quarters per cent.

251. Can you describe the process of applying it?—Th way we do it is, we mix it with whatever salt we ar going to use, and it is then sprinkled over the butte previous to being finally blended and packed into th various packages. That is working it on the factory system, as it is called.

252. What is the relative cost of these preservatives compared with salt?—A preservative would cost abou twenty times as much, bulk for bulk, as salt would.

253. That would be bulk for bulk, but what I mean is: Suppose you had two quantities of butter, one to be preserved by salt and the other by a boracic preservative, what would be the relative cost of applying the two substances?—It would cost probably four times as much at least to use the preservative.

254. I am not taking bulk for bulk, but what would be requisite with the same quantity of butter?—Yes, I know, and I am giving you the requisite quantity.

255. Have you ever had any complaints from your customers as to the presence of preservatives?—No, I do not think we ever had; I cannot call to mind any.

256. I suppose you would regard with some apprehension any prohibition such as exists in Denmark to the use of preservatives?—Yes, I believe it would injure the Irish butter producers and merchants very seriously.

257. (*Professor Thorpe.*) I should like to ask Alderman Dale, who has probably followed these matters very carefully, whether in his opinion there should be any essential distinction between the procedure of the Irish butter manufacturer and the Danish butter manufacturer?—I

really could scarcely say. Some people contend that the Danish butter is closer in its texture than the Irish butter, but I have not sufficient personal experience to say of my own knowledge whether that is so or not.

258. Would that mean that the Danish butter contained less water, for example, as a rule, than the Irish butter?—Some people say so.

259. You have no actual knowledge of that fact?—No, I have not experience of Danish butter sufficient to say.

260. Are you aware that practically half the butter imported into this country is Danish butter?—I am aware that there is a very large quantity, but I cannot call to mind the exact proportion.

261. What I should like to get at, if I could, is what essential distinction there should be, or is, between Irish and Danish butter, because the point that you raise, namely, that the Danish butter generally enters into a quicker consumption than Irish butter, considering that half the butter imported is Danish butter, can scarcely be, one would think, a quite sufficient reason?—I think, generally speaking, that one of the main causes of the difference is that, while the Irish farmers were, owing to causes partly their own, partly otherwise perhaps, which I need not go into, very backward in adopting improved methods of butter-making, the Danish farmers, owing to certain circumstances under which they worked, adopted improved methods very much earlier than the Irish farmers, and so absolutely got command of the English market, which command they have retained to a large extent up to the present time, although Irish butter of late years is certainly regaining its lost ground very much.

262. Why have the Danes retained command—is it the excellence of their production that enables them to do that?—Partly its excellence and partly the fact that their butter was very superior for many years, and they gained hold of the English taste, which they retained naturally, although at the present time I believe that a great deal of the Irish butter is equal in excellence to Danish butter owing to the improved methods now employed in Ireland.

263. Much of this mild-cured butter or butter absolutely unsalted is prepared solely for the English market, is it not?—Yes.

264. Specially for the South of England?—Yes.

265. Considering the proximity of the Cork butter market to the South of England, would there be any insuperable difficulty in obviating the use of borax for a market so near to you?—Unsalted butter or extremely lightly salted butter would not keep in hot weather for twenty-four hours without showing some sign of deterioration if there were not some preservative, I believe. The Danish butter scarcely comes under that designation of unsalted or extremely lightly salted, as they use a certain percentage of salt. Normandy butter would compare more with the Irish in that respect.

266. Very well. Now, as regards Normandy butter, we heard yesterday that the only method of protecting Normandy butter was by enclosing it in a cloth which is steeped in boracic preservatives, and that actually no such preservative was blended with the butter. Are you aware that such is the case?—I am not aware, but I could quite imagine that it would have much the same effect, because the butter would absorb it, more or less. Of course, if the outside surface of a mass of butter is protected from injury the inner part will not be so liable to it.

267. Has that method of protecting the butter been tried by your Association?—It has; some shippers I know adopt that system, but at the same time they used a certain amount of preservative in the preparation of the butter also.

268. Is there anybody who exclusively adopts that system?—I am not aware.

269. The preservative you actually use is boracic acid?—It is a compound prepared from different ingredients, the chief one of which is boracic acid.

270. Can you tell us what the other ingredients are?—I cannot.

271. What is its trade name?—The one I use is called Preservitas.

272. Does much of your butter go to a distant market from Cork?—There is not very much now except what goes packed in hermetically sealed tins.

273. Is that liable to change?—Not so liable as it would be in any package into which the air could enter. Of course, the tin being hermetically sealed it will theoretically keep the butter good for any length of time; practically it keeps it very much longer than if it were in a wooden package or other package that would admit the air.

Mr. H. Dale.

15 Nov. 1899.

274. In such butter it is not necessary to add any more preservative than would be required for the English market, is it?—No. I am aware that some people who pack in tins do not use a preservative, even those who use it in other packages.

275. They manage to send it without any preservative?—Yes, with a certain amount of salt. All the tinned butter contains a reasonable amount of salt, rather more than for the English market.

276. But, nevertheless, it does not come up to the heavily salted butters that you are referring to?—No, not quite to the heavily salted butters of former years.

277. What I gather is that it is possible even with a reasonable amount of salt, and a due provision as to excluding it from the air, still to keep the butter sound for a practically indefinite period?—If it is hermetically sealed, yes.

278. (*Dr. Tunnicliffe.*) Do you dust the boracic acid on the butter as it is being rolled?—Yes.

279. You said before it was finally blended you did this. What do you mean by being finally blended?—Put into shape to be packed into whatever packages it is going into. It is generally done on what we call the butter table; when it is passing under the rollers the salt is added at the same time.

280. There is nothing else added but the preservatives?—Nothing else.

281. Except some colouring matter, of course?—Yes, in some cases there is a colouring matter.

282. You said that a good preservative was soluble; what do you mean by that?—One of the objections to the use of preservatives originally was their insolubility—that there was a danger of the little granules of acid, or whatever it was, not being dissolved, and so being injurious to the human system, but the manufacturers that sell prepared preservatives have found some means by which they make them very soluble, so that a quantity, if put into water, will absolutely disappear, and in the same way in the butter it becomes quite soluble, and does not retain its granular form.

283. (*Dr. Bulstrode.*) Could you give the Committee any idea of the cost per lb. of this preservative of which you are speaking?—It costs about 6d. per lb.

284. I mean the added cost per lb.?—The addition to the cost of butter do you mean?

285. Yes. How much does the boracic acid, or whatever you use, cost per lb. of butter?—It would be infinitesimal; it would be about three-fourths per cent. of sixpence, or sevenpence, or eightpence—whatever the cost per lb. of the preservatives—so that it would really be an extremely small thing; about the fourth part of a farthing.

286. So that the use of a little, more or less, would not be a very serious matter financially?—No, it would not; it would be the sixteenth of a penny, say, per lb. of butter.

287. Do you think anything under a half per cent. would be of any use?—I think not.

288. That is a half per cent. of the preservative which you have been accustomed to use, or of boracic acid—which are you now speaking to?—Half per cent. of any of the ordinary trade preservatives; that would be less than a half per cent. of boracic acid.

289. In your experience nothing under a half per cent. would be of any use?—I think not.

290. Do you add different amounts of preservatives at different times of the year, or is the proportion constant?—We maintain a constant proportion—three-fourths per cent. is what we use.

291. Do you use three-fourths per cent. all the year round?—Yes.

292. How long do you think, in the hottest months of summer, or the hottest weather, that butter so treated would keep?—I have had experience of its keeping quite good for three or four months.

293. How long does the butter take to come from Cork, shall we say, to the English markets?—To London it will take about two days.

294. How long does it take the butter to come from Copenhagen, or wherever it is exported from in Denmark?—I cannot say positively, but it is a short run from Copenhagen to the North of England, I know.

295. It would be quite as long from there as from Cork, would it not?—Scarcely as long. I had in my mind the

Mr. H. Dale.

15 Nov. 1899.

North of England when I spoke of Denmark. Of course, most of it comes to Newcastle-on-Tyne; that is the chief port at which the Danish butter is landed, I think.

296. At any rate, it does not take a shorter time for butter to come from Denmark to England than from Ireland to England?—Not materially shorter, I suppose.

297. So that if they can get a ready market for their goods in England there is no reason why the Irish farmers should not get a ready market for theirs, *caeteris paribus*?—As I mentioned just now, there is one thing which the Irish butter producer at present is fighting against, and that is the established preference which the Danes have got owing to their earlier adopting better methods. We are now engaged in trying to regain the ground which was lost during the time that Danish butter was becoming firmly established in England.

298. And you do not think you could possibly do that by adopting the method which the Danes adopt?—I think it would handicap the Irish producer very much.

299. Why?—Simply for the reason that in hot weather especially the butter would certainly begin to go off quality after, of course, I cannot say exactly how long, but after a comparatively short time.

300. The Danish butter does not go off quality, does it?—It does, of course, if it is kept any time.

301. But you would not say, looking at the enormous sale of Danish butter, that in actual practice the receivers of that butter had any objection to it even in hot weather?—No, of course not. As I say, Danish butter is mostly sold now to arrive, and it goes then into consumption straight away; but a good deal of the Irish butter that is sold here at present is consigned or shipped on the chance of being sold.

302. (*Professor Thorpe.*) It is quite true, of course, as you say, that the greater part of the Danish butter comes into ports in the North of England, not only Newcastle-on-Tyne, but other ports out of the Tyne, as far south as Harwich, and no doubt is distributed straight away?—Yes, I believe so.

303. It is distributed from those ports as centres, and I presume one reason why you send Irish butter to the South of England is for the same reason, namely, that you have say, in Bristol, a distributing area for the south?—Yes.

304. That is the reason, practically?—It is one reason; but a good deal of the Irish butter comes to London now rather more than to Bristol, I should say.

305. On account of the geographical proximity of both the West of England and of London to the South of England?—That would affect it, of course.

306. Do you happen to know what is the average amount of water in your Irish exported butter?—The average, I should say, would be from 12 to 13 per cent. perhaps.

307. Not more?—Not more, I should say, for the average.

308. (*Chairman.*) You have a standard, have you not?—No, there is no standard actually established; it varies very much according to the state of the weather, and the state of the cattle, and the feeding they get. I did prepare some time ago, for another Committee, tables showing the variations. I cannot call to mind now exactly what it was, but I have known butter that was perfectly honestly made beyond any question to contain over 20 per cent.—quite 22 or 23 per cent.; on the other hand it will run down as low as 10 per cent. at times.

309. (*Professor Thorpe.*) When you say honestly made, what do you mean?—Without the intentional addition of moisture.

310. Do you not think that it is a factor determining the preference for Danish butter, that as a rule the Danish butter contains less water than Irish butter?—It is quite possible it may be.

311. And that there is less loss to the retailer in making it up in the case of the Danish butter than in the case of Irish butter?—I should think, on the whole, it possibly does contain less, although I am not able to say from personal knowledge.

312. But you would think if it did contain less that that is one determining reason why a preference is given to it?—It would naturally be so.

313. (*Chairman.*) Before we leave this subject of Danish butter I should like to ask another question, as we are very anxious to get at the bottom of the difficulty. You have spoken of Danish butter as being principally consigned to the North of England, and that coincides with my enquiries in Denmark; but are you aware that from the North of England it travels very far, and is sold in retail qualities even in dairy countries at a higher price than the local product—even in Ayrshire and Wigtownshire, which are large dairy countries?—So I understand.

314. Ho wdo you account for that?—I presume it must be better than the local produce.

315. Yes, but that is not the difficulty; there is no doubt it is better. If, as you say, unpreserved butter is so perishable in your experience that a preservative is essential, how can you account for Danish butter being sold by retail dealers in the West of Scotland?—I can only suppose that it is sold within a reasonably short time of being landed.

316. You do not know, or suspect, that the retail dealers add a preservative of their own?—I do not know.

317. You have no knowledge of that?—No, I do not know of it.

318. (*Dr. Bulstrode.*) I did not quite gather from what you have said as to the method of applying the preservative, exactly how the preservative you use is applied to the butter?—In my own factory, which I speak of now, as having most personal knowledge of, when we are blending a lot of butter it is done on the Normandy system. The butter is bought fresh from the farmers, and it is blended so as to produce uniformity. It is passed through rollers on a butter table, and when the moisture has been as far as possible got out of it it is salted and prepared for packing in boxes or firkins, as the case may be, and at the time the salt is added the preservative is also sprinkled over the surface of the butter.

319. With the salt?—Yes; it is then turned over and over with wooden hands until it is thoroughly mixed, and then packed into the various packages.

320. Is any more preservative put into the packages; is there any more sprinkled over?—No.

321. Do you stipulate that the people who supply the blending establishment with butter shall not themselves add preservatives?—No, we have no means of enforcing it.

322. As far as you know they may add a preservative before it reaches you?—I think we would probably detect it if they did.

323. Do you take measures to detect it?—Yes, our inspectors go round and very carefully examine all the butter. Of course, it is possible that it may be added, but I do not think it is probable.

324. Do they analyse the butter for boracic acid?—We have analysed it occasionally; we do not do it regularly.

325. I mean for all you know the butter which you send out may contain more preservative than that which you put in?—It is, of course, possible.

326. (*Chairman.*) Now, you have told us about preservatives, and we are much obliged to you for that. Have you anything to tell us about colouring matters used in the trade?—Colouring matter is used to a certain extent but I have not given any particular consideration to that.

327. I suppose the uniformity of colouring from year's end to year's end is desirable?—Yes, as nearly as possible. Of course, summer butter, Irish butter, at any rate, from the month of May outwards, is naturally a rich, yellowish colour, so that it is not necessary to use any colouring matter with it; it is only in the winter that it is really necessary.

328. And what is used?—We use a fluid colouring, but I do not remember at the moment now what it is called. We have tried a great number of different colouring matters, and had them analysed from time to time, and we have adopted one, the name of which I really do not remember at the moment. Saffron used to be used, but I do not think it is used so much now.

329. Do you know what are the components of the colouring material that you use now?—Saffron, I presume, would be one of the chief components.

330. Have you no curiosity to know what you are putting into your butter?—I think we have had it tested, but it is so long since that I really do not remember what the result of the test was. We tested it practically, and also we had it analysed at one time.

331. You actually retain no recollection of what the material is that you are putting into the butter?—No, I really am unable to say, because I have not considered that I would be asked about it, and so I have not looked the matter up.

332. (*Dr. Bulstrode.*) Might I suggest that you should

furnish the Committee with the name of the colouring matter that you use, or with the address of the place at which you get it?—I will be very happy to do that if you wish.

333. (*Chairman.*) We would be obliged to you if you would do that?—Yes, I will.

334. (*Professor Thorpe.*) Perhaps Alderman Dale can tell us, since he says he has made a number of experiments on the subject of the application of various colouring matters, what colouring matters he has actually used in times past?—We used saffron pure and simple for a very long time, and then annatto, and various other preparations came out, and we have tried a number of them, principally by practical tests, that is by colouring certain portions of butter with two or three different preparations and then testing which retained its colour for a length of time, regarding that as being the one that was most useful.

Mr. H. Dale.

15 Nov. 1899

335. You cannot give us any information as to what those colouring matters were?—I could not without looking it up, but I have in my office at the present moment, I know, two bottles that we prepared some years ago with two different colouring matters; one retains a rich yellow colour still, and the other is absolutely white.

336. Do you know whether you were in the habit of using any other colouring matters than vegetable colouring matters?—I think not.

337. For example, you do not use any aniline dyes, do you?—No. So far as that goes I know that we have adopted the opinion, and stuck to it, that vegetable colouring matters are the most desirable.

338. (*Dr. Bulstrode.*) Are you prepared to tell us about the use of preservatives in cream?—No, I cannot say that I have any practical knowledge of that.

339. (*Chairman.*) Is there any general statement that you wish to make to the Committee?—I do not think so.

Mr. HENRY SHANAHAN, called; and Examined.

Mr. H. Shanahan.

340. (*Chairman.*) You are a partner in the firm of M. E. Shanahan and Son, butter merchants, Cork, are you not?—Yes.

341. You are also connected with the Association of which Alderman Dale is president—the Cork Butter Exporters' Association?—Yes. I am also managing director of the Cork and Kerry Creamery Company.

342. You have heard Alderman Dale's evidence as to the general features of the trade, have you not?—Yes.

343. Do you corroborate him?—I do not think that a half per cent. of preservative would be sufficient to keep the butter.

344. What proportion would you put as necessary?—The preservative that would contain a half per cent. of boric acid or boracic acid. I think Alderman Dale stated that it was half per cent. of the preservative.

345. He stated that as a minimum?—Yes, he stated as a minimum a half per cent. of the preservative, but I would say half per cent. of boric acid or boracic acid, because half per cent. of the preservative does not contain half per cent. of boric acid.

346. What are the other components of the preservative?—I could not tell you. When preservatives originally came out, I should say it was about twenty-two or twenty-three years ago, we were all looking for a preservative for butter besides salt, and then there was a preservative came out called boric glyceride, I think it was. I think the patentee was a Professor Barff, of London. I got that. It was a very costly thing, and what was more it was very unworkable. It was like a wax, insoluble; you could not dissolve it. It was something like honey—between honey and wax, if you can understand—you could draw it out, but it was unworkable upon butter, because you could not get it to spread round the butter. I tried to get that analysed to know what was in it. There was boric acid, or boracic acid and glycerine, and I do not know what the other ingredients were. But we could not get it together again. You could analyse it, but you could not get it together again. I think it is something the same with the other preservatives.

347. Preservatives generally?—Yes, preservatives generally—that is, the known ones.

348. There is some medium in them?—Yes. Of course, the basis of all is boracic acid. I have only tried two preservatives. I have used boric acid itself without anything put in.

349. Why did you discontinue its use?—I thought the preservative was better. It is more soluble, you know. The great difficulty we found with the boracic acid was that it was insoluble. The way we applied it was this: We would dissolve a lot of it—pounds of it—in hot water, we would put as much boracic acid as the water would dissolve and then leave that to cool. We would do a lot of it, so as to have it ready. The butter would pass through it before it would be put upon the butter table. We found we could not dissolve the borax in the butter. If you put half per cent. of it in it without its having a solvent with it, you can see it in the butter.

350. Now, do you use a preservative in a liquid form?—No, not now; now we use a preservative that is not liquid. Originally when we used the boric acid we made a liquid preservative of it ourselves. Hot water, nearly boiling, would take up about 1 in 30, or 32—I am not exactly at the right figure—but it is 1 in 30 say, and then when that would cool the solution would only hold about 1 in 50, I think—something in that proportion. The moment when this water would cool down it would not hold so much in solution, and the acid would fall to the bottom. That was before the preservatives came out.

351. (*Professor Thorpe.*) Did you work that solution like so much brine into the butter?—No, we did not work it in at all. We washed the butter through it. I do not think Alderman Dale exactly went into the matter of the factory. Of course, you know it is different from the creamery. The factory system means, as is done in Normandy, that you buy the butter fresh from the farmer, and you get it all into the factory daily; then you wash it to get the butter-milk out of it, because the Irish farmers leave a great deal of butter-milk in the butter. You cleanse it of the butter-milk. Of course, there is a lot of water in it. We have a machine which we call a Normandy machine. The butter is washed by machinery by rollers. It is in the form of a funnel. The butter from the farmer is lowered in on the top, and the rollers catch it and run it down—that is, tip the butter into the bottom; in the meantime there is water pouring on it. Then you take that up, and it is put into a tub of that shape—(*indicating*)—a big high tub with two arms working inside it. It is the machine that is used in Normandy. There is a hole ready *here*—a square hole in the centre—and when the butter in thrown into this, the arms going round squeeze all the water out, and force the butter out through this hole. Then it is taken from that and put upon the butter tables to salt. You see whatever water gets in when we are passing it through water, in rinsing the butter-milk out of it we squeeze out by this Normandy machine.

352. (*Chairman.*) At what point in the process do you apply the preservative?—We apply the preservative, as Alderman Dale told you, on the butter table when we are mixing the salt with it.

353. That is after it comes through the roller?—After it comes through the squeezer.

354. After it comes through the Normandy machine?—Yes. We do not apply it exactly as Alderman Dale does. We did do so, until there was this row about boracic acid being injurious to health; and we were restricted in the quantity, because then we had to be very cautious that there was not more than 0·5 per cent. put in.

355. Then in the factory you uniformly use half per cent.?—Yes; but we do not apply it in the salt.

356. You do not apply it in the salt?—No; we apply it on the butter itself, and then put the salt on top of it—at the same time with the salt, to be certain it contains only the half per cent., for fear of any trouble.

357. What is your view of the Danish principle of prohibiting preservatives altogether?—My view of it is that they must have used it when they passed the Act to prevent it originally. I think originally that is what gave us a beating in Ireland. They would not have passed the Act if it were not used.

358. Do you know when the Act was passed?—It is not very long ago, I am sure; I could not tell you myself, but I never heard of it till about four or five years ago.

359. At all events it has not interfered with the Danish trade?—No, it has not interfered with that trade I think.

360. Would it interfere with the Irish trade if it were imposed on the Irish producers?—It would you know; it would lower the value of butter very considerably when the farmers had large quantities.

361. It would lower the value to the producer, but it would raise it to the consumer, do you mean?—No, it would lower it to the consumer I fancy, for the time being. There would be a lot of bad stuff you know thrown on the markets, that is all. In June, July, and August really there is not consumption for all the butter that is made in England and Ireland and Denmark; there is not a consumption for it in England, and if it all had to be thrown on the market together as it was made—the weeks it was made—why there would be such a quantity there that it would be down to almost any price. I have often seen it in former years down to 4*d.* or 5*d.* a lb.

362. Not Danish butter?—No, but Irish fresh butter. We hear that the Danish butter is higher; but we do not know what price the farmer gets for it. I am speaking of the price the farmer gets for it.

363. This Committee has nothing to do with that. The point before the Committee is whether the use of preservatives is essential to the Irish butter trade; I understand from you you consider it to be so?—Yes.

364. Then the natural question is why is it not essential to the Danish butter trade?—Of course, I have been thinking of that matter for a long time, and the conclusion I have come to is that Danish butter will naturally keep better than Irish butter.

365. Because of its superior manufacture?—No, because of the food of the cattle, and the cattle themselves, and the ground. For instance, you will find two farms close together in Ireland, and the butter of one farm will keep, and the butter of the other will not, though they will belong to the same man.

366. Then you assume that the whole of Denmark is of such a nature that it produces grass from which the butter is of superior keeping quality?—Yes; I know that in Ireland you may take two different farms or two different districts, and in one the butter will keep splendidly, and in the other it will not keep at all.

367. I suppose in the factory you mix the butter of all the farms up together?—Yes, in most cases.

368. In order to get a uniform quality?—Yes; we have different qualities you know, but each quality has to be uniform. We do not mix the bad and the indifferent and the good butter together.

369. Can you tell us anything about colouring matters?—We use colouring just, of course, to have the colour of the butter uniform, for two different butters will not be of the same colour.

370. What is the nature of the colouring matter?—Danish butter colouring?

371. What is it composed of?—I could not tell you, but we get, for instance, the same as what the Danes use.

372. You have no idea of what it is composed?—No; there is a very small quantity of it required.

373. Where do you get it from?—We used to get it direct from Copenhagen, but we get it through a Dublin house now. They have an agent in Dublin, and it is through him we get it.

374. And you are satisfied with their assurance that it is Danish colouring matter?—Yes.

375. (*Dr. Bulstrode.*) Do you know the composition of the preservative material which you use?—No, it is a trade secret.

376. How do you ascertain when you are adding it that you are not adding more than the ·5 per cent. of boracic acid having regard to the fact that you are dealing with an unknown substance?—By putting in three-quarters per cent. of the preservative.

377. Then you do know the composition of the preservative?—That is what they inform us; the manufacturer informs them. He takes the risk; he says if you put in three-quarters per cent. of preservative you will not have more than 0·5 from it, and then he takes all the risk from us.

378. That is on the instructions then?—On the instructions of the manufacturer.

379. Do you know if there is much of the Danish butter imported into England that goes bad before it is sold?—I do not know very much about the market for Danish butter, but I was always under the impression, at least some years ago, and I know it to have been the case, that Danish butter arrives to be sold at Manchester, say, and when it arrives it is sold, say, on a Tuesday—that was the market day in Manchester formerly, and I think it is now, but I do not do much up there now; but if any of that butter remained unsold until the following week it was always down by three shillings or more a cwt. Danish butter the second week was not as good as it was the day it was landed.

380. Are you sure the diminution of price is due to deterioration in quality and not to fresh supplies?—Yes, that is what I mean; because, you know, otherwise it would be higher if the market went up.

381. You say that you made some experiments to see whether refrigeration could obviate the necessity for using preservatives; could you tell us what your experiments in that direction consisted of?—We put butter in with a preservative and without it, and we found that it did not keep at all as well without it.

382. When there was refrigeration?—Yes, in the refrigerator. When the butter was packed it was put into our refrigerating chambers. We have them in the place, you know, and then we brought them out week after week for a few weeks, and we found that the butter with the preservative kept much better than the other did.

383. When it was taken out from the refrigerator?—Yes, after being in there and testing it; after being in there a couple of weeks or two or three weeks, whatever time we tested them for.

384. That is all you have done in that direction—simply to put treated and untreated butter into the refrigerator, and observing the time for which it would keep fresh?—Yes, the time that it would keep good.

385. (*Dr. Tunnicliffe.*) You regard, of course, the introduction of boracic acid as a preservative as being a great improvement in the manufacture of butter?—Yes, I do. Of course, the subject must not be injurious to health; if it is injurious to health, that is another thing.

386. As a manufacturing detail you regard it as an improvement?—Yes.

387. Can you tell us of any other improvement that has been adopted in Ireland in the manufacture of butter within your experience?—The factory system and the creamery system are both improvements that have been adopted since I have been in the trade. I may tell you that the farmers in Ireland, twenty years ago say, were very careless in making up butter; in fact, they never properly washed the butter milk out of it. That is the reason that we got the machinery to wash it out, because if you left butter milk in it, and did not have it properly washed, all the preservatives in the world would not keep it, and to have it properly salted you had to have the salt right through the butter. Of course, since the taste in England has come more and more for fresh butter, you had to put less and less salt in, and the chances were that it was not evenly distributed when you had a great bulk of salt.

388. So far as you know those are the three improvements that have been made—the creamery system, the factory system, and the introduction of boracic acid?—Yes.

389. Otherwise the manufacture of butter is now what it was before?—Yes.

390. Therefore, what arises is that in June, July, and August the butter which is not used, by virtue of its having a preservative in it, is kept over until there is a demand for it?—Yes, that is practically it.

391. Is it kept over by you, or is it kept over by the retailer?—Generally by the retailer, unless butter might be very cheap, and then you would like to go in for a speculation by keeping it yourself. Generally speaking, it is the man in England that buys the butter.

392. And he keeps it?—Yes. You know it would be this way: What we generally do with the June butter, say, is we get 50 tons in a week, and if there is only a demand for 40 tons we would have 10 tons over for next week, and that 10 tons that would be over for next week we would send out first, you know. If there was the same short demand for the next week, of course we would have another 10 tons or 20 tons. Do you follow me?

393. I quite follow you?—I do not mean to say that in June if you had 10 tons over you would keep that 10 tons until September; it would not be that 10 tons you would keep, but it would be a fresh 10 tons.

394. I quite understand what you mean. I think it is quite clear?—You know it is not the 10 tons in June

Mr. H. Shanahan.

15 Nov. 1899.

that we would keep over until August or September; we would always keep putting out the oldest of it unless the party who bought the butter would want to get it on direct quickly. If we were speculating for ourselves, that is what we would do.

395. How much butter do you keep in June, July, and August, roughly—how much is there over each week to go on to the next week?—That depends a good deal; I could not state to you any quantity, because sometimes we are short even then, you know.

396. Sometimes you are short then?—Yes, I would be short. Say that I had a great big supply of 50 or 60 tons; I might sell 60, you know, and I would have none over. It occurs sometimes, and then perhaps if I had not enough of butter for my week's demand, Alderman Dale might have his 10 tons over to keep on. I could not exactly tell you what the quantity is.

397. Anyhow, you do not keep any more over in those months than any other months?—That is according to circumstances. Of course, we never keep any over in September. It all regulates the price, too. If the price was low I should not be very anxious to put it out, but if the price was high, I would be very anxious to get it out, as a natural consequence, not to lose money on it. A butter merchant here will buy a lot of butter from you in June and in July, knowing the butter will keep, and he will hold it in his place for some time.

398. What guides you entirely in keeping is the current price then?—That guides me solely in keeping it; and that butter will keep, you know, of course. A merchant here will buy Irish butter when it comes down to a certain point in July and August, and that relieves the market in Ireland, and he does that knowing the butter will keep; but if he knew the butter would not keep he would not buy it, and it would be left there.

399. How does he know the butter will keep?—He knows the Irish butter will keep. Unfortunately for Ireland, when butter used to be salted, when the choice was between Irish salted and Danish fresh, the grocer in England always knew that Irish butter would keep, and when he bought Irish and Danish he would sell off the Danish, and put the Irish aside. He used to work off his Danish knowing it would not keep, but he would not work off the Irish.

400. That is what used to happen when the butter was heavily salted?—Yes.

401. What happens now, do you know?—There is something of the same.

402. Do you think he works off the Danish first now?—Yes.

403. Then, if he knew the Irish butter would not keep it would be a good thing for the Irish butter trade to a certain extent because he would sell it first. That follows from what you say, does it not?—Yes.

404. About cream. Do you do anything in the matter of cream?—No, I do nothing with cream.

405. (*Professor Thorpe.*) If I have understood you rightly it is the question of price to some extent which affects your use of preservatives?—No, it would not be the question of price that affects our use of preservatives at all; it would not matter to me whether butter was 4d. a lb., or whether it was 8d. a lb.; it is all the same thing to me.

406. I understood you to say that by adding something which you know preserved the butter you are able to tide over a period of depression in price?—You are able to tide over a period of depression in price; but that is not a benefit to you—it is a benefit to the producer.

407. (*Chairman.*) You said that the ordinary normal application of preservatives enabled you to do so?—Yes.

408. But not their special application. You do not vary the application of preservatives according to the market price?—No, we always use the same.

409. It is a uniform quality?—All the same all the year round.

410. (*Professor Thorpe.*) I understood you to say that at certain times you would not put your produce on the market if the prices were low, and that you would hold it back?—If the prices were low?

411. How low?—That would be under what I gave for it, so that I would lose by it?

412. Yes?—That would be so; but if I could not put a preservative into the butter to sell it—and this is where the whole point comes in for Ireland—I would not pay the farmer so much money for it; therefore, I could not lose. For instance, if butter was 8*d.* a lb.—and if that would be just a fair price, this is when there would be a glut in the market—I would run no risk because I know that by putting in the preservative the butter will keep, and I can hold it over if necessary a week or two, because the price of butter is very fluctuating, you know, from day to day. I would give him 8*d.* a lb. for it then; but suppose that I knew the butter would not keep, I would not give him 8*d.* for it; I would give him 6*d.* for it very likely, and try to sell it cheaper in England. That is where the whole thing come in. It will not be injurious to the merchants; it is nothing to them; it will be injurious to the farmers.

413. That is what I wanted to get out from you. The natural effect of this practice is to hold up prices?—The natural effect of the practice is not to glut the market with the produce. The supply is bigger than the demand, and you could glut the market.

414. That comes to the same thing, of course?—You know, it is not like mining; the cows are there, and they will have the milk, and the farmer has got to make the butter; and if we have a very good season, and a very good make of butter, the supply is bigger than the demand.

415. If that operated do you not think the Danes would be equally affected by it. I mean they have got to live, so to say, from hand to mouth. They have got to get rid of their yield of butter, and to get it away, and to take the risk of prices have they not?—Yes; but I do not think as far as I know that the produce in Denmark varies so much between summer and winter. They have summer dairying, and they have winter dairying, and they do not have a surplus like what we would have. I know very little about the Danish trade except that it seems to me always to be coming in in about the same quantity all the year round.

416. Are there causes in Ireland which would prevent that kind of thing?—Yes.

417. What are they?—Winter dairying is very expensive in Ireland. They have never tried winter dairying there, it is too expensive.

418. But the climate in Ireland during the winter is more genial than it is in Denmark?—The food of the cattle is quite different there, you know. I do not know actually, only from what I have read and heard about it from importers of butter—they do not feed the cattle in Denmark on roots as they do in Ireland. In winter, you know, they feed all the cattle on turnips and mangolds in Ireland, as they have nothing else, and then they let the cattle run dry in winter because, of course, the butter is very bad in the winter—it is all turnipy, you see.

419. You mean in Ireland?—Yes, in Ireland; and where we would be doing, say, in June and July, 30 to 40 or 50 tons a week, in winter it runs down to as low as 5 or 6 tons a week in Ireland.

420. I should like to take you on that point, because I think it is very important to know what are the conditions in Ireland which would operate against the adoption of the Danish system as regards the prohibition of preservatives. You told us that in Ireland even two contiguous farms would yield butter of very different keeping qualities?—Yes.

421. One would keep and the other would not?—Yes.

422. I do not quite understand. Perhaps you will explain what is your theory of the cause of that?—Off limestone ground in hot weather the butter is very soft; if the weather is very hot it comes in almost fluid, almost in oil, it is so very soft. If you get butter off a brownstone land the butter is hard; it is good you know, and it will keep; it is not in that soft state that the other is; it has an ordinary texture in it and hardness.

423. Everything else being the same, say, the breed of cows?—Yes.

424. The period of lactation of the cows?—Yes.

425. Everything being the same?—Yes.

426. Now, to what do you ascribe that; I suppose they both feed on grass?—To the soil; the one is limestone soil and the other is brownstone.

427. And you think the grass so essentially differs in chemical nature, or in some nature, as to cause that difference in the milk?—Well, the difference of a limestone ground is what it is; in the other it is of a different nature. All farmers know that. They know that butter off a limestone land will be always very soft in summer and hot weather.

Mr. H. Shanahan.

15 Nov. 1899.

428. You have no knowledge why it should be soft other than what you have told me?—No, I have not.

429. I mean, do you apprehend that there is any difference in the chemical nature of the butter?—There is in the chemical nature of the soil.

430. Of the butter, I asked you. Why should one butter be more fluid than the other butter unless there is some difference in its chemical nature?—I do not know; I only know what is. I do not know what it would be due to.

431. You do not know?—No, I do not.

432. Is the fluid butter?—When I say a fluid butter I do not mean that it is a fluid. I mean very soft. In very hot weather it is what we call almost in oil. That is what I mean, almost in oil.

433. The more easily liquefiable butter, we will put it in that way—that which melts at the lower temperature?—I do not know what temperature it melts at; but if you get a piece of that butter you cannot get it to stand up on the plate, it will all spread out almost, you know, and if you get a piece of another butter that will stand up straight on the table. That is what I mean.

434. That is what I want to get at—are there any differences in the characteristics of the two butters other than the ease with which they melt?—One will keep and the other will not.

435. Anything else?—And when they are salted one will harden properly, as it should, and the other will not.

436. Anything else; any difference in flavour, or in the aroma?—No. Do you mean when it is made up?

437. Yes, when it is made up?—Well, I do not know that there is any difference when you get it except it might be a little heated, you know; you would get a heated smell off the soft butter.

438. May I ask if you have formed any idea, or are you aware what causes butter to become rancid?—We always thought it was through not having it properly washed after being churned, and also not salting it quickly enough.

439. Not salting it quickly enough?—Yes.

440. That is, therefore, some imperfection in manufacture?—Yes.

441. Do you not think, therefore, that as you improve the process of the manufacture to the pitch of perfection we will say there is in Denmark, you could equally with the Danes do without preservatives?—I do not think so.

442. But you have already in Ireland, of course, made great steps in improvement; are you not suffering in this particular from some residuum of imperfection which you have not yet got rid of?—I will take creamery butter; that is made with all the modern appliances the same as in Denmark. Tested immediately with Danish butter you would prefer the Irish creamery butter; if it was properly made Irish creamery butter you would prefer it of the two. But keep them there for a week, and you will have Irish butter running off faster; we cannot keep creamery butter at all.

443. Why?—That I cannot tell you.

444-5. (*Chairman.*) Did you say running off faster than the Danish butter?—Yes.

446. Going bad?—Yes, running off in quality.

447. (*Dr. Tunnicliffe.*) Becoming rancid in short?—Becoming poor, you know, getting staleish. We have fourteen or fifteen creameries in the South of Ireland, and we take the milk from the farmers direct every morning, separate it ourselves, and do all the work ourselves there with all the modern appliances, and I suppose they are fully equal to anything in Denmark.

448. (*Professor Thorpe.*) And your view is that this arises from some essential difference in the nature of the material you are dealing with?—Exactly, whatever that is caused by.

449. And which cannot be overtaken by any improvement in the treatment either by more adequate washing or by some process of sterilisation, or by some other detail of manufacture—you think you cannot circumvent it?—No. We sterilise our cream—well, as you call it sterilising; we Pasteurise it, and then bring it down and churn it at between fifty and sixty.

450. (*Chairman.*) You Pasteurise the milk?—Yes.

451. Before the cream is taken off?—Yes.

452. All of it?—We Pasteurise the cream in winter too.

453. Do you Pasteurise all your milk?—Yes, we do Pasteurise all our milk.

454. All the milk that comes into your creameries?—Yes. Now, you know, we are very particular about it. We run it up to about 170 degrees, and then we churn that out under 60.

455. What is the object of Pasteurising it in this case?—It is to get rid of any taint of feeding.

456. Such as the turnip taint?—Yes.

457. (*Dr. Tunnicliffe.*) How often do the farmers bring their butter to you? How often in the week, for instance, or in the day, as the case may be?—In the summer some of them bring it twice a week, and more once a week.

458. In winter once a week?—Yes, and some of them in the summer only bring it once a week also.

459. How often do you send out butter as a finished product?—Daily.

460. Could you give the history, so far as your manufactory is concerned, of any individual lot of butter that you send out? For instance, suppose you send out some butter on a Wednesday, could you tell exactly how long it had been in your factory, and so forth?—Yes.

461. You could?—Yes.

462. What is the maximum time you keep it?—We do not, as a rule, keep butter in our factory longer than the second week.

463. The second week?—Yes, in our refrigerating chambers; the cooling rooms. We have cooling rooms to keep the butter in, and the butter that would be made this week we would like to see it all out by Saturday week. We would keep it thirteen or fourteen days in some cases, if we did not sell it then.

464. About a fortnight is about the maximum time that you would keep the butter?—Yes, that is the maximum time I would like to keep butter. I would not sell any butter after that as fresh-made butter, you know.

465. Would you sell any butter that you had kept longer than a fortnight?—We put it into the cooling chambers.

466. Would you sell it?—Yes.

467. What would you sell it as?—As cold-store butter. We would tell the parties it has been in the cold store for so long.

468. So you have two classes of butters to send out, the cold-store butter and the fresh butter, so called?—Yes.

469. How long do you think your butter would keep without any preservative whatever?—I have known butter keep perfectly good——

470. Your own butter produced exactly under the conditions under which you work?—My own butter I am speaking about. I have known butter to keep perfectly well for, say, three weeks or a month. My salt butter would keep very good for three weeks.

471. Mild butter, I mean: I do not mean heavily salted butter?—No, I am speaking of mild butter; we only do mild butter. We do not do heavily salted butter in our factory at all unless we have an order for it.

472. You have known mild butter to keep for three weeks without any preservative whatever of any kind?—Yes.

473. When was that?—That would be butter that was made in cool weather; I do not mean in winter weather, but on a cool summer day, and there was no difficulty in churning that butter. Certainly there would be no difficulty in washing it and salting it. It would be a good solid butter. I have known that butter to keep for three weeks perfectly good. But all the butter we get is not like that—that is not the bulk of the butter made in Ireland.

474. But that was a saleable butter which you got by the method by which you get the butter now—there was no mystery about the getting of the butter?—No, but at the same time I have known other butters that we have done perhaps the week afterwards that would not keep for a week.

475. In your opinion could you reply upon your butter keeping for a week without the addition of a preservative?—Yes, I could rely on some of it.

476. That is the point. I did not say some of it; I said: Could you rely upon your butter keeping for a week?—No, I could not rely on all of it.

477. But some butter has kept three weeks?—Yes.

478. And that in moderately cool weather, not in winter weather?—Yes, in moderately cool weather.

479. (*Professor Thorpe.*) Have you observed any connection between the keeping quality of the butter and the period of lactation of the cow—I mean, does it matter at

Mr. H. Shanahan.

15 Nov. 1899.

what period of the lactation of the cow the butter is yielded, as to its keeping quality?—I do not understand what you mean by the lactation of the cow.

480. Of course, a cow gradually tends to become stale, does she not, and the character of the fat that she gives is known to vary slightly?—Yes.

481. Does that affect the keeping quality of the butter within your experience?—I have never tried that.

482. You have no knowledge of that?—No, I have no knowledge of it.

483. (*Chairman.*) Suppose a retail dealer were to find fresh Danish butter going bad upon his hands, would the addition of a preservative arrest the putrefaction?—No.

484. It goes on all the same?—Yes, that is my experience with butter going bad; when it gets to a certain point going bad nothing will stop it.

485. (*Dr. Bulstrode.*) How long do you say that the butter is likely to be on the hands of the farmers before it reaches you; you said, I think, they send it in once a week?—Yes. He makes his butter, say, this afternoon and I have it in the morning.

486. From what you know you would not say that they are in the habit of using any preservatives themselves?—No, I cannot say that they are, but I am very well certain that they are not; they would add nothing at all that they would have to pay for.

487. You do not think in your method of making butter that you have anything to learn from the Danes?—I do not think so.

488. Have you visited Denmark and examined the methods of making butter there?—No, I have not but we have got the machinery put up. You know the Danish system is the creamery system, and all our creameries that are put up are of the same kind as the Danish. Then there are Danes over in Ireland in several of the creameries there; experts are over there employed in Ireland. The factory system is the Normandy system. I have been in Normandy.

Mr. JAMES HUDSON, called; and Examined.

Mr. J. Hudson.

489. (*Chairman.*) You are the chairman of Hudson Brothers, Limited?—I am.

490. Are you butter merchants?—We are provision merchants, and we deal largely in butter.

491. Have you been connected long with the trade?—Over fifty years.

492. Doubtless you have seen some changes during that time?—Yes, very many.

493. Can you tell us the chief character of them?—I well remember in the forties and fifties particularly, and even into the sixties, our butter used to come with 4 and 6 per cent. of salt, so much so that after the cask had been cut in two the salt would stand out in globules on the butter itself.

494. What was that—Irish butter?—Irish butter particularly, but all butter was very much salted in those times to keep it; it would not have kept the time otherwise. For instance, they had to make good quantities of butter during the autumn of the year to run through the winter, so that that was very much salted. Such butter in the present day would not be useable; the public would not have it at any price. Since the preservative has been used there is no necessity for more than one to two per cent. of salt at the outside, and with all the fresh butter that we get there is no need for salt at all, because that is used within three or four or five days, or a week we will say. Fresh butter is used within a week at the outside.

495. Do the factories consign the butter to you?—Yes.

496. And it arrives with the preservative already in it?—Yes.

497. Do you ever have occasion to add a preservative?—No, we never do that; we think that the half per cent. is quite sufficient, and the trade would be only pleased to know that a law was passed that no more than half per cent. should be used. We do not for one moment think that half per cent. or even a little more is bad for the article or deleterious. Of course, I do not know what 3 or 4 per cent. might be, but if there were 3 or 4 per cent., or even 2, or even over 1, we should detect it.

498. By the flavour?—By the flavour; it gives a flat taste, so that you would say at once there was more preservative than was necessary.

499. Do you feel satisfied that the proportion of one-half per cent. is seldom exceeded?—I know that it is not exceeded in what we obtain, because we object to any more. We know it is necessary for the half per cent., and they guarantee to us that no more than the half per cent. is used.

500. Do you check that from time to time?—Only from the flavour. The half per cent. does not destroy the beautiful flavour of the butter in the least, but my belief is that 1 per cent. or 1½ would. For years I have had cows of my own, and have used it all through the year, and also with the cream to the extent of half per cent.

501. Do you deal in foreign butters as well?—Yes, colonial principally; through the winter from New Zealand and Australia. In the summer time we deal a good deal in Irish butter. If this preservative was prohibited I do not know what would be the results. It would be a very bad thing for the producer and also for the consumer, because I contend it is of great service to the consumer to have two or three pounds of butter in to-day at his house, and to know that it will keep good till he has finished it.

502. Do you deal in Danish butter at all?—Very little of late, because we find that the Normandy butter through the summer and the colonial butter through the winter is more uniform and gives greater satisfaction, and is less trouble to us. We get no complaints with it.

503. Are you aware that Danish butter is free from preservatives?—I have heard so, but it never keeps as well. I know that, and I should say, therefore, that probably that is the case.

504. It does not keep as well as Normandy or Irish butter?—No, nor as well as the New Zealand butter. You see, we get the New Zealand butter from 3,000 miles away made in the summer. It comes to us, and is put into cold storage. It is taken out as we want it, and is as good as if it was made the day before. There would be a great injury done to all those who use it now—to the colonies, to America, and to Ireland in particular—if it was to become law that no preservatives should be used.

505. Do you deal also in other provisions; in bacon and ham, for instance?—Yes, but in our English bacon and hams it is not used to any extent at all; probably in the summer time in the very hot weather they might just sprinkle a little in at the pocket of the fore end of bacon, which is very sensitive to flies, and no fly will touch it then. Probably you are aware that in the spring of this year the French Republic prohibited the importation of American bacon and hams, because it is used considerably—to what extent I could not say. They prohibited the importation of it, and in three months the export from America to them was nothing. They then rescinded the prohibition, and they are taking it now as they did before.

506. When you receive a consignment of bacon or ham what process does it go through?—The bacon is smoked. It all comes to us in a green condition, and it goes into the smoke holes—large places, with many floors—and is smoked.

507. Is it washed or scraped first?—It is washed off.

508. And that gets rid of the preservative?—That gets rid of the preservative if there is any, but there is none in Irish bacon or English bacon, as they do not use it. They use it slightly in Irish hams. Then there is saltpetre; that is used in both bacon and hams to colour, and from what I have heard from the faculty, if the preservative is injurious at all, saltpetre is far more so.

509. I understand that your company has received a summons for the use of a preservative?—Yes, for cream, amongst a number of others. We took the case up ourselves, and are carrying the matter thoroughly, and we trust, successfully through. We are getting all the evidence we can.

510. It is still in court, I think?—It is still in court. It was adjourned until to-morrow, but I heard to-day that it is put off to the latter end of the month.

511. Then I suppose we must not discuss it?—You can ask me any question you like about it; it is all a matter of public knowledge.

512. What was the amount of preservative in that?—In this half a pound of cream?

513. Yes.—Sixteen grains; it was at the rate of about

Mr. J. Hudson.

15 Nov. 1899.

a quarter per cent. and a fourth decimal. I do not know whether you saw Dr. Bond's evidence.

514. Not in this case.—He stated that he was coming before you.

515. I believe he is?—Of course, I will not anticipate him; he will tell you.

516. How long will the cream stand with a quarter per cent. of boracic acid?—I should say four or five days, it may be six. We should have to give up the sale of cream in the whole of London if there is a law passed to do away with the use of this boracic acid, for the cream does not keep twenty-four hours in the summer time. Now, a customer comes into us and buys two or three pots of this cream, wanting it to keep a week, or at any rate four or five days, and it does do that.

517. I suppose we may take it that the general use of these preservatives tends to increase the consumption of these articles very much?—Undoubtedly.

518. It makes them accessible to a number of people who would not otherwise get them?—Undoubtedly. If you had a pound of butter on your table that had turned you would eat very little of it, but if it is there in a good state you eat your usual quantity. I might tell you that there is another thing we have been doing for years. A joint, or two, or three joints, are ordered at one time from the butcher, because I like it to be well hung; in the summer time it is sprinkled over with this out of a pot like pepper—just sprinkled over the joint. We hang that up in our larder for a week or ten days, and then use it. We always get a tender and a nice joint through that. The same with game, you pepper some pheasants that have been killed to-day, and you may hang those pheasants for three weeks or a month, and they will be perfectly good. I have sent several packages of this boracic acid down into Norfolk in the shooting season at the beginning of October, and some of my friends have adopted that system.

519. How does it affect the object for which meat and game are generally hung for a certain time, namely, to get a little tender?—It gets tender, but does not go off in flavour. In the matter of game it would stink if this was not adopted, and does. A pheasant in hot weather would not keep a fortnight, scarcely a week—in fact, it would be bad at the end of a week in very hot weather. Of course, packing has somewhat to do with that. If you shoot a pheasant on your own estate, and hang it up in a cool larder, it will keep considerably, but if it is packed and sent to London it will very soon spoil in very hot weather—that is if October happens to be hot, and close, and muggy.

520. I quite agree, but what I mean is that if decomposition is totally arrested how is it that the meat gets any tenderer by using this preservative?—We have always considered it is very much better for the hanging. You see it only applies to the outside; the boracic acid does not enter the meat; it is just sprinkled on very slightly, and that is quite sufficient.

521. (*Professor Thorpe.*) You perhaps know that in France they are generally very particular as to the use of preservatives and colouring matters, and things of that kind in their food?—Yes.

522. They have somewhat stringent regulations on the subject?—Yes.

523. In the case of this action of theirs as regards the bacon and hams imported from America, do you know that it was because their attention was drawn to the fact that the boracic acid or the borax which was actually used was practically all washed off the surface of the ham that they were induced to rescind the law?—I am not aware of that fact. I only state the fact as I have heard it, and from what I have heard people say that export to them. I mean the agents here.

524. Have they withdrawn the prohibition as to the use of preservatives in other articles of food?—That I do not know.

525. (*Dr. Bulstrode.*) Is it fair to ask you in reference to this prosecution which is now going on whether 16 grains in half a pound of cream is a common amount found; have you any objection to answering that?—I can only answer it in this case because this was analysed, and that amount was found in it.

526. But still you know about the practice of preserving cream?—I should think there is never more than half per cent. used, because it is not necessary.

527. Never more than half per cent. in cream?—No, it is not necessary.

528. What preservative are you speaking of in reference to the half per cent. here?—Boracic acid.

529. Do you purchase it as boracic acid?—Yes.

530. And not as a patent; you simply purchase it as boracic acid?—Just so.

531. (*Chairman.*) Have you got anything to tell us about colouring matters?—I do not know much about colouring matters; I only know that in the winter here they are used for butter so as to make it uniform with the colour of summer butter. It is not necessary to use any colouring matter in the summer when the cows are out to full grass; but as soon as you feed them upon hay and roots then there is no colour to the butter at all, or little or none.

532. Do you sell any cheeses?—Yes, we do a large trade in cheeses.

533. I suppose the North Wilts, even in summer, requires something to colour it up?—Yes, it does, because the foreign trade always wish for a highly coloured cheese; they will not take the pale cheese. Now, from my point of view, I do not think it is necessary at all to colour cheese; I do not think it adds to the quality.

534. Can you tell us what the composition is of the colouring matter? Take your North Wilts, or the Double Gloucester—is it annatto?—That is it, thank you; annatto is used.

535. That is what you are informed?—Yes, that is what I am informed.

536. But you do not know?—No, I do not know, for I have never made cheese. Some cheese you know—the Canadian cheese, for instance—is coloured. A good deal must be used in North Wilts and in Double Gloucesters; but none of those cheeses keep as well as a purely white cheese.

537. I suppose a Scotch cheddar will keep as well as a Somersetshire one?—My experience of Scotch cheddars is this, they are never equal to the English; they are not to blame for it, it is the food, the nature of the grass. You can only make Stilton cheese in Leicestershire and in the neighbourhood of that county. Every other county has tried to produce Stiltons, and they cannot. It is the nature of the food that produces that particular curd.

538. (*Dr. Tunnicliffe.*) At the present time is the sale of Danish butter increasing to your knowledge in relation to that of Irish butter or is it decreasing?—It is decreasing, I should say, speaking from my own knowledge, but I may not be perfectly right, because I have not seen the statistics. That of Irish butter is increasing immensely. It is becoming a great thing for Ireland. These creameries are growing up all over Ireland, and they are producing most excellent butter, such butter as we never had before from Ireland. Do away with boracic acid being used to a small extent, and you stop that trade altogether.

539. Do you know when Danish butter began to decrease in consumption, I mean roughly?—I could not say. We have given up the use of it for the last two years, and I have heard of other people giving up the use of it.

540. For how long? For the last two years?—Yes, and from that I judge that probably it has decreased, though I could not really say for a fact that it had, as I have no knowledge of the statistics of the quantities.

541. Has colonial butter—by that I mean Australian or New Zealand butter—to some extent taken the place of Danish butter, or is it mostly Irish?—It has entirely through the winter with all good houses.

542. (*Chairman.*) I do not want to ask indiscreet questions, but it would be interesting if you could give us some idea of the proportion in which Irish butter has been substituted for Danish buter in your trade?—I do not quite understand your question.

543. You say that you are selling now more Irish butter than you used to do, and less Danish?—That is so.

544. If you could give us approximately some idea of the extent to which that alteration has taken place we should be pleased to hear it?—I should say that the trade with Ireland has increased 200 per cent. within this last, we will say, five or six years.

545. And diminished with Denmark, how much?—That I could not say.

546. (*Dr. Tunnicliffe.*) You do not add any preservative to the butter after it reaches you in any way whatever, do you?—No, never. We do not keep it on the premises. I think that would be very dangerous, particularly so with milk.

Mr. J. Hudson.

15 Nov. 1899.

547. Do you have a good lot of butter over that is consigned to you?—Yes, we have large quantities. I think our trade is something like 20 or 25 tons a week.

548. What do you do with the butter that is over. I mean do you have butter on your premises in a condition that you cannot sell it?—No, it goes straight into cold storage, and we take it out of our cold storage as we require it daily, so that it never spoils.

549. How long do you keep butter. What is the maximum time that you have kept butter in your cold storage?—Canadian butter we have kept three months.

550. You have kept it three months in your cold storage?—Yes, and took it out as we wanted it. It is as perfect as the day we had it.

551. That, of course, contains a preservative?—Yes; we have such an opportunity of knowing how the article is appreciated by vending it as we do all over London and the suburbs, and I assure you now we seldom or ever get a complaint. In the old days there were constant complaints.

552. What were the complaints?—Complaints of the butter turning off. People got so used to it that they would come in and say "Well, Mr. Hudson, I know it is a bad time of the year, but do as well as you can for us." Now if we send a bad piece of butter to a family they will write and tell us not to call any more.

553. (*Dr. Bulstrode.*) How long has cold storage been in use for butter?—We have been using it now for about five years.

554. Have you ever tried the effect of cold storage on butter treated with preservatives, and on butter without them?—Have you made any experiments of that kind?—No, I cannot say that I have.

555. Not as to whether it alters the keeping qualities when it is taken out of cold storage?—No, but my impression is that butter without the preservative put into cold storage would keep just as well, but after you had had it out and it melted or rather softened if the frost went out of it, it would turn off at once. That I know from experience to be the case.

THIRD DAY.

Thursday, 16*th November*, 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. JOSEPH EDWARD PROSSOR, called; and Examined.

Mr. J. E. Prossor.

16 Nov. 1899.

556. (*Chairman.*) Are you a partner in the firm of Rehoe, Donnelly, and Packenham, Dublin?—Not a partner, but manager. I think it is only right to tell you that when you sent me the summons I was the manager of the Yorkshire Bacon Company.

557. It was not a summons, but an invitation?—Thank you. Since then I have just been appointed by Rehoe, Donnelly, and Packenham the manager of their new place, which is now in construction.

558. Have you been connected with the trade a considerable time?—About thirty years.

559. I do not want to detain you longer than is necessary, and I will therefore ask you generally if you concur in the evidence which we have received as to the change in the character of the trade, namely, the greater demand for mild-cured goods and the general substitution of preservatives for salt?—Yes. We cannot sell the heavy salt-cured goods salted on the old system; we could not sell them at all now.

560. We have had very much evidence about that already; therefore I think we may assume that that is your experience also?—That is my experience, certainly.

561. Now you use other preservatives than salt and saltpetre?—Yes.

562. What are they principally?—I principally use dry antiseptic. It is made by Douglas. It is a mixture of boracic acid and borax, so I am led to believe.

563. How do you apply it?—It is dusted over the meat. In the curing we use what we consider enough salt and saltpetre to make a mild cure; then we simply use the preservative to keep that cure till the meat is sold.

564. Are your firm curers?—I have been a curer for the last thirty years.

565. Where do you get your carcases from chiefly?—Everywhere I have been we have always killed the pigs ourselves. I have been in the West of England; I have been on the Continent for eight years: I have been in the south of Ireland, and I have been in Yorkshire, so I have had a pretty fair experience.

566. Perhaps you would describe the process as far as you can without revealing any trade secrets?—The pigs are first killed and disembowelled, and allowed to hang for some hours to cool; after that they are passed into the chill rooms, where they are generally allowed to stop for a night, or, say, twenty-four hours—it depends on how hot they are—until the animal heat is perfectly removed, say to a temperature of about 40 degrees. After that they are cut in the various cuts for whichever market they are required, and taken into the salting chamber, where they are salted. This is the process of salting; the side is laid down on the flags and slightly sprinkled with salt and saltpetre on the surface, and a small quantity of antiseptic is shaken on. After about nine to ten days the bacon is removed from that and thoroughly washed and hung up, and allowed to drain or dry, and either sent out pale dry or smoked, as the case may be.

567. Does it receive any further treatment with the antiseptic after its removal from the salt?—We find that the first is all that is required, but sometimes if the weather was very warm I would just wash with the solution to prevent the fly from getting in.

568. Roughly, what amount of antiseptic do you use on the side?—From about a quarter of a pound to one pound per hundred pounds of meat, but very seldom one pound; I have used that amount, but I consider that a quarter of a pound for general purposes is all that is necessary.

569. I understand that after that the meat is washed?—It is thoroughly washed as a rule in luke-warm water to take every trace away of salt and anything that may remain.

570. Do you find that meat so treated is less liable to go bad or to get tainted than under the old system?—If meat was not treated in that way it should be made much more salty, as it would not "hold."

571. I understand that you use the same antiseptic with fresh meat in your own household?—Yes, I have used it for, I suppose, twenty years, or something like that. We generally have a large canister of it at home, and we cover the meat up in it, and, in fact, pretty well everything we use. I have used it myself. I was summoned on the trial at Pontypridd about boracic acid in ham, and there I heard some evidence from, I think it was, Professor Attefield, who said he took a teaspoonful of it and found no ill-effects. When I got home I thought I would do the same, and I took a teaspoonful in a glass of water, and then I took half a teaspoonful every morning, or pretty nearly every morning, for three months in a glass of water, and I found no ill-effects of any kind. I did that just for my own information. After hearing the evidence there I thought I would try and test it my-

Mr. J. E. Prossor.

16 Nov. 1899.

self. It does not look as if it had done me much harm; I believe it to be perfectly harmless.

572. What was your connection with the trial at Pontypridd?—I gave expert evidence as to the use of boracic acid—much the same as here—to the effect that it was required.

573. Did you give evidence for the defence?—Yes.

574. (*Professor Thorpe.* Were you able to perceive any effect whatever upon yourself from taking that quantity of boracic acid?—I think it made me rather more hungry; I seemed to have a better appetite. I fancy that it makes you eat a bit more. I have taken it for indigestion, and I have given it to my wife for indigestion. I believe it is a very good thing for that, and I think it answers, and that it has very much the same effect as pepsine; but, not being a medical man, I am not in a position to say. I think it is rather preferable to pepsine for indigestion. I may be wrong, as my medical training has not been very much.

575. (*Dr. Tunnicliffe.*) When did you take the half-teaspoonful?—In the morning, just before breakfast.

576. Before breakfast?—Yes; I go out before breakfast every morning, and I took it when I came home.

577. You took it on an empty stomach?—Yes.

578. Do you suffer from indigestion as a rule?—Not unless I eat unripe apples or anything of that kind.

579. Nor from wind or anything of that kind?—Not, I suppose, more than most people.

580. Anyhow, the indigestion you did suffer from you thought was improved?—It is so very slight that I cannot say.

581. Did you take boracic acid?—I took the antiseptic.

582. (*Dr. Bulstrode.*) How long is the antiseptic kept in contact with the meat?—It is shaken on the meat until the meat is cured, then everything is washed off.

583. How long does it take from the time of shaking on the preservative to the time the meat is cured?—From seven to ten days as a rule.

584. The boracic acid is kept on that length of time?—The preservative, I should say, is.

585. You say it consists of boracic acid and borax in this case?—I believe so.

586. It is kept in contact with the meat from seven to ten days?—Yes.

587. And then washed off?—Yes.

588. How much boracic acid do you think is necessary for the effects of the preservative to be manifested; how much do you think ham ought to contain?—As a rule, we use, as I say, about a quarter of a pound to 100 lbs. of meat, sometimes a little more if the weather is very warm; but a quarter of a pound is generally sufficient.

589. A quarter to one pound per 100 lbs. of meat?—From a quarter to one pound; I have used up to one pound, but that is very seldom necessary. Of course, I put it fully when I say that. What we use is generally about a quarter of a pound.

590. Do you think that the meat should contain that amount in order to preserve it?—I do not suppose it contains all that, because there would be a good deal of it washed off.

591. How much do you think?—Suppose you used, say, 1 per cent., what percentage would you say would be found in the interior of the meat?—That is not a question that it is very easy for me to answer; I have never investigated the thing, but I should say very small.

592. Do you think any gets into the meat?—I should think some gets in; if it did not get in I daresay there would be no effect.

593. You think it must be absorbed in some degree, at any rate?—I should think so, to have the effect it has.

594. Do you think you would get the effect which you state it has by simply dusting the hams over with a preservative when you pack them for transit?—That is the American, and I believe the Canadian, method; it is the American method, anyhow. They pack them in dusted borax.

595. You do not do that as a rule?—No, ours are smoked as a rule.

596. The boracic acid in your case is added much earlier than in the Canadian method?—I cannot tell you what the Canadian method of curing is. I have never been in Canada myself.

597. Do you not know the condition the hams are in when they come over here, nor at what point in the process they are shipped to ngland?—I have seen them packed in borax, and seen that washed off; but how they cure it I am not in a position to say, as I have never been in Canada.

598. Beyond this method of dusting with borax you also at times wash the meat with a solution of boracic acid or preservative?—Sometimes. Then we wash that with water again. That would be simply to take off any slime or anything that might adhere to the meat.

599. You say that in your own household you have used considerably more than 1 per cent.; about how much have you used?—We generally when we buy a beefsteak on a Saturday cover it over thoroughly, or if we have fish or fowl, or game, we add some. We have never measured it; we take a handful, say, and put it over it.

600. (*Chairman.*) Do you give the meat so treated to children with confidence?—Yes, certainly.

601. And have never found any evil effects?—No, never. I have never heard from anyone of any effects.

602. (*Dr. Tunnicliffe.*) You took this half-teaspoonful quite regularly for three months?—I may have missed a morning or two.

603. Did you notice any difference in your weight during that time?—I could not say

604. You did not notice anything perceptible, anyhow?—No; I did not notice anything. I just took it, hearing the evidence in that case; I thought I would try it on myself.

605. You do not know what weight half a teaspoonful of the preservative would be, I suppose?—No.

606. (*Dr. Bulstrode.*) Was it the preservative that you took?—Yes.

607. (*Dr. Tunnicliffe.*) You only wash the boracic acid off, and do not steep the side in any solution afterwards?—No.

608. You simply wash it off?—We wash it off generally with lukewarm water.

609. Off the surface?—Yes.

610. (*Chairman.*) Is there anything that you would like to state generally before the Committee?—No, I do not think so. If there is any question you would like to put I would be very pleased to answer it, but I do not think there is any further statement to make.

Mr. H. Trengrouse.

Mr. Henry Trengrouse, called; and Examined.

611. (*Chairman.*) I believe you are the senior partner in the firm of H. Trengrouse and Co., Tooley Street, London, Provision Brokers?—Yes.

612. And you also represent here, I think, the London Chamber of Commerce?—Yes; I was selected by the London Chamber of Commerce at a recent meeting of our provision trade section to come to-day.

613. Like other witnesses, I suppose, we may assume you can testify to the revolution in the trade in cured provisions?—Yes.

614. And to the preference of the public for mild cured?—Yes, undoubtedly.

615. And the consequent necessity—or, at all events, expediency—of using some kind of preservatives?—Certainly. My firm represents the great packing house of Armour and Co., Chicago. We are their oldest European representatives, so that I can hark back to the time when we had nothing but hard salted bacon and hams. It is quite a revolution now to have this mildly-cured bacon and other pork products from distant countries.

616. Now, what takes place; they are mildly cured over there?—Yes.

617. Then are they laid in preservative powder?—Yes. Borax is the chief preservative used now, instead of common salt as formerly.

618. Borax or boracic acid?—Boracic acid, I imagine. Bacon and hams from the States are dusted with borax powder, which is a fine powder. They always come in that form.

619. Do you wash that off?—Yes.

Mr. H. Trengrouse.

16 Nov. 1899.

620. Similarly butter, I suppose, in which your firm deals largely?—Yes, very largely. In fact, I think we may claim to have been the pioneers of the Australasian butter industry. We were the first to send a man to New Zealand to look that article up.

621-2. Would it be possible to bring butter fresh from New Zealand without the use of preservatives?—I should say not. It would have to be consumed immediately, and that is not always practicable. We do bring unsalted butter from New Zealand and from Australia but it has a little boracic acid in it.

623. In cold chambers?—Yes, always in cold chambers below freezing point.

624. Then how long can you keep it in this country when it is brought out of the cold chamber?—It should keep even in a temperature such as we have now for two or three weeks. Without boracic acid, as is commonly known, it would deteriorate very rapidly.

625. Now, is boracic acid mixed with the substance of the butter?—Yes, it is thoroughly incorporated with it, I should say—thoroughly mixed.

626. Do you deal at all with French butters?—Yes.

627. Is a preservative also mixed in the substance of those butters?—I should say so, though you must understand that we are not manufacturers or producers of butter—we merely deal with the butter as we get it for sale. Of course, we can easily detect any objectionable qualities in it.

628. We had in evidence from a former witness that the French factory butter was not mixed with the preservative, but was simply packed in cloth saturated in it; you cannot speak to that?—No; I could not say anything on that point. The boracic acid is, or should be, thoroughly incorporated with the butter in Australia; it comes in square boxes of 56 lbs. each in grease-proof paper.

629. Have you anything to do with Danish butter?—Yes.

630. Does that also contain a preservative?—I think not, but it contains a small percentage of salt, possibly 1 per cent., or rather more. The Danes, I believe, do not use any boracic acid.

631. Do you find a greater difficulty in keeping Danish butter?—Yes. Danish butter arrives very shortly after leaving the churn, and goes into consumption immediately.

632. The same applies to Normandy butter, does it not?—Yes, that needs a very rapid sale; it is exceedingly mild.

633. The Normandy butter?—Yes, also Brittany butter.

634. In spite of the preservatives?—Yes, it is very mild, but without the preservative it would only keep good for a very short period.

635. I understand that you find less difficulty in dealing with Danish butter, which has no preservative, than in dealing with Normandy butter, which does contain a preservative?—Yes, it is of a totally different character. There is more moisture in Normandy and Brittany butter than in Danish butter. The Danish butter is very solid and very free from moisture; the other is more like fresh cream, is it not? We are all acquainted with Brittany butter; it has a very creamy flavour, and it is scarcely butter at all, it is more of the character of cream. This has to be eaten from day to day, otherwise we know what happens to it.

636. It is of a more delicate manufacture?—Yes, it is of a much more delicate character.

637. It all passes through factories, does it not?—Yes, I should say so.

638. I suppose all butters are brought up artificially to a uniform colour?—Yes, to a great extent. I should say that colouring matter would be used at the majority of factories; annatto, I imagine, is the only colouring agent employed.

639. Have you information to convince you that annatto is the chief colouring matter?—I have never heard of any other colouring matter. There are manufacturers now of various colouring articles, but I do not know of what those consist. Annatto has ben used in this country I should say for fifty years in colouring butter. Mr. Lovell can give you much more information than I can on Brittany and Normandy butter; he is more largely interested in that department than we are.

640. Are there any other substances besides bacon and hams and butter in which the use of preservatives is general in which you deal?—No.

641. You do not handle fruit?—No, only provisions and butter. We handle large quantities of tinned goods, chiefly beef, brawn, and ox, and lunch tongues.

642. Are they treated with anything?—Only slightly salted; corned beef, for instance, would have the usual percentage of salt to give it the desired flavour.

643. Do you deal in cheese?—Yes.

644. Of course the colouring comes into cheese?—I believe annatto is the only article employed in colouring cheese.

645. Even in the high-coloured ones like the North Wilts cheese?—In some parts of the country high-coloured cheese is demanded; they will only have highly-coloured cheese; in other parts they will only have white cheese or pale cheese with just the slightest colour.

646. (*Dr. Bulstrode.*) How do you ascertain that the butter which comes from the several parts of the world from which you import contains from one-half to three-quarters of a pound of the preservative to 100 lbs. of butter?—That is merely our suggestion, we do not know exactly what the butter contains; it is our suggestion that a half to three-quarters per cent. would be quite innocuous and desirable in the preservation of butter. Our instructions to factories are to use 0·5 per cent.

647. Do you test that butter quantitatively for boracic acid or other preservatives when it reaches you?—No, we do not test it at all; that is, unless trouble should arise, as was the case last year. There were two or three prosecutions in South Wales; it looked more like a bit of persecution than anything else. The local analyst there professed to discover two per cent.

648. In what butter was that?—Australian butter.

649. As far as you know, there may be even more than 2 per cent.; I mean you have no regulation or condition of purchase that the butter shall not contain more than 0.5 to 1 per cent.?—Nothing whatever. You see, we are at the mercy of the shippers and manufacturers of the butter on the other side.

650. What do you do with the butter when it reaches you?—It is sold now throughout the country. At first there was a very strong prejudice against Australasian butter, but that has been overcome now; the quality has been considerably improved, and some of it is practically equal to Danish, but it does not obtain the Danish price by a long way.

651. Do you add preservatives yourselves at all?—Not the slightest—oh, dear no! We sell it as we get it.

652. Do you know why it is considered necessary to add preservatives to butter imported from, we will say, Belgium, Holland, and France?—That butter is of a more delicate character; as I said just now, it contains more moisture. It does not keep so well as the more solid Australian butter, from which a great deal of moisture has been expressed.

653. But it is necessary, you say, to add preservatives to Australian butter?—Yes, we think so. Without some preservative, it would come here absolutely mild, and would deteriorate very rapidly indeed, especially in mild weather. In the absence of boracic acid salt would be needed, and to a greater extent than most consumers like.

654. Does the Danish butter deteriorate very rapidly?—Yes, I should say so. It is intended for daily, immediate consumption. It is practically fresh. I suppose the Danes use at least 1 per cent. of salt; at any rate, it is not absolutely free from salt.

655. Do you think that it would be possible, in the event of your dealing with a partially decomposed butter, to add boracic acid and thus veil its decomposition?—No, I do not think so. I do not think boracic acid tends to conceal defects at all. I should think not.

656. Do you think salt would?—Yes. Formerly, as you may remember, the worse an article was the more salt was introduced into it.

657. With a view of veiling decomposition?—Yes. When an article is very heavily salted you can only taste salt unless the decomposition should be very marked indeed.

658. (*Chairman.*) Does boracic acid impart any perceptible flavour?—No, unless very largely employed, and then we consider that there is a sort of metallic flavour; that is, we have detected a metallic flavour in butter which we have attributed to boracic acid. I may be wrong, that is merely a suggestion.

659. (*Dr. Bulstrode.*) How much boracic acid was there in that butter in which you detected this flavour?—I

Mr. H. Trengrouse.

16 Nov. 1899.

could not say. I do not think the manufacturers of butter introduce boracic acid to a large extent with any object beyond the preservation of the butter. But too much gets in perhaps by the people at the creamery putting in a little, and then when it reaches the factory more may be introduced. There is no regulation in regard to the introduction of this boracic acid.

660. Would you suggest regulations?—It is very difficult to do so, is it not? There should be some system on which boracic acid is introduced into butter, I think.

661. (*Chairman.*) You spoke of butter passing from the creamery to the factory, did you not?—Yes.

662. Is that the regular course?—I think so in Australia. There are many creameries there in which the cream is extracted from the milk and then sent a long journey by rail—scores of miles in some instances—to a central factory, where it is converted into butter. We have been under the impression that that might account for the large percentage of boracic acid. At times there is a posibility, I suppose, of unequal distribution of boracic acid.

663. That is not the usual course in continental factories or Irish factories, is it?—I could not say positively.

664. The butter is generally made in the creamery in this country?—That would obviate the risk of a second dose of boracic acid.

665. (*Dr. Tunnicliffe.*) How long do you keep butter yourself before you dispense it, so to speak?—Our object is to clear each shipment before the next arrives. We get weekly shipments now from Australia, and if we fail to dispose of it as stated we put it into cold storage, otherwise it would very rapidy deteriorate, being of a mild character, as now demanded by the metropolitan consumer. The consumers of meats now in large cities neither like salt nor fat; formerly they did not mind a litle salt—a good deal, in fact.

666. It goes from you to the retailer, does it?—No, we are entirely wholesale; we sell to wholesale buyers, who distribute it.

667. It goes from you to the wholesale people, and then remains with them no doubt some time?—Yes.

668. And then goes to the retailer?—Yes.

669. And then finally to the public?—Yes, that is the system; and would involve a week or ten days.

670. How long do you think it would be necessary to make butter keep after it has arrived in this country from the point of view of trade reasons; I mean, beginning at the shipment and ending at the retail dealer?—The conditions on the other side are totally different from ours. The moment the butter is made there it is placed in a refrigerator, and in that condition it would keep indefinitely. When it reaches us it is sent about the country; it goes to the wholesaler's warehouse to begin with, as you suggest, and then——

671. I do not think you quite understand me; what I wanted to ask you was what length of time you think it would be necessary to elapse between the arrival of butter in this country in the ship and the final selling of it to the public?—I should say from two to three weeks.

672. You think all butter ought to be, so to speak, cleared and in the hands of the public within two to three weeks of its arrival in this country?—I should say so; it is a question of temperature to a great extent. I give you two or three weeks as an average period.

673. So, therefore, in order to ensure the keeping of butter for a month from its arrival in this country it would be necessary, in your opinion, to have preservatives?—Yes. Butter distributed as Australian butter is must have some preservative to keep it, otherwise it would more nearly resemble the Brittany butter, which is very delicate, and goes off in two or three days.

674. In regard to the water, did you say there was more water in Danish butter than in Normandy butter?—Considerably less.

675. Considerably less water?—Yes, considerably.

676. Do you know anything about Irish butter?—No, not very much; we get a little to sell, but we are chiefly interested in butter from the Australian Colonies and New Zealand.

677. How long do these butter ships take to come from Australia?—Five to six weeks.

678. What is the highest quantity of boracic acid or borax in butter that has come under your knowledge?—Three per cent. has been alleged. There was a prosecution at Birmingham a year or so ago, and I think 3 per cent. was alleged there, and 2 per cent. alleged in South Wales last year. We have heard of 3 per cent., at any rate, but no ill effects whatever have arisen from the consumption of the butter alleged to contain this high percentage.

679. (*Professor Thorpe.*) Of the amount of butter imported into this country, how much, roughly speaking, is Danish?—I have not the figures with me; I know that we pay millions a year to the Danes for butter; they have the bulk of the butter trade.

680. They have the bulk, have they?—Yes; our Irish friends allowed the butter trade to drift to Denmark, and it is still retained there to a great extent. There is an enormous trade in Danish butter.

681. I suppose the butter trade is of very considerable importance to Denmark?—Yes; indeed, it is of vital importance, I should say. Butter and bacon are the chief industries in that country.

682. Why, then, in that case can they do without the use of preservatives?—It is a very short voyage, you see—four or five days.

683. Does the whole of the butter which is made in Denmark come here?—I should say nine-tenths of it, or practically all.

684. (*Chairman.*) I know to the contrary—a great deal of it goes to Paris?—Then we possibly get it viâ France. I am of opinion that relatively only a small quantity goes to France.

685. (*Professor Thorpe.*) You are not aware that they do any considerable export trade from Denmark other than with us?—No; the provision trade would not know of the exports to France, I imagine.

686. On what does the keeping quality of the Danish butter really depend if they can do without the use of preservatives?—I do not think they do; I think they introduce at least 1 per cent. of salt.

687. But nothing else?—Not to my knowledge.

687*. I think the use of boracic acid is prohibited, is it not, by law in Denmark as to butter but not in regard to bacon?—I have heard so, but I am not sure.

688. They can get on without it, apparently?—Yes.

689. And still maintain their high position in the trade?—They do undoubtedly—to a great extent, may I say, because they have been in possession of the field for a long time, and supply England all the year round. There is plenty of Australian butter quite as good as Danish.

690. Do you know any reason, for example, why Irish butter should not equally be introduced into this country without boracic acid?—That has a shorter journey still.

691. Do you see any reason why it should not?—For immediate consumption it would be all right, but one has to look to contingencies—the weather, and absence of demand.

692. But you said the vast bulk of the trade was done by butter which was for immediate consumption?—Yes. For the Metropolis, I suppose, it is chiefly Brittany and Normandy butter, which is of a very delicate character.

693. But Danish butter, you say, has got by leaps and bounds, as I gather from you, at the head of the trade?—Yes.

694. And yet that is a butter which apparently must be used immediately?—Not so immediately as the Brittany and the Normandy butter. The Danish butter would keep all right, I should say, twice as long as the Brittany butter. It is of a tougher texture; the more moisture you get out of it, I imagine, the longer the butter will keep; that enhances the keeping properties of the butter; the drier it is the longer it will keep.

695. If the butter is reasonably free from moisture you think its keeping quality greatly improved?—Yes, undoubtedly.

696. That therefore would obviate the use of preservatives?—I should say so, to a considerable extent, but I do not like to speak with very great authority on this point. Mr. John Lovell is an expert with regard to Brittany and Normandy butter, and can tell you a great deal about Danish butter.

697. Does the Danish butter command a relatively high price?—Yes, it does.

698. The highest price?—No. Brittany butter commands the highest price, because it is so fresh and delicate, but Danish, I should say, is chiefly used by the ordinary middle class consumer.

Mr. H. Trengrouse.

16 Nov. 1899.

699. Is there any relation between the price of the butter and the amount of water which it contains?—Yes, the higher the percentage of moisture the lower the value of butter. Some manufacturers allow a good deal of moisture to remain.

700. That you think diminishes the keeping quality of their products?—Yes, I think so.

701. In your experience do some butters deteriorate more rapidly than others, apart from the question of preservatives; for example, do you notice in your dealing with various imported butters that some go off quicker, as it is called, than others?—Yes. The degree of deterioration arises, I think, from a mild character and the amount of moisture; the larger the amount of moisture and more delicate preparation the sooner it goes off.

702. (*Chairman.*) I do not think there is anything else, Mr. Trengrouse, unless you have anything you would like to state to the Committee?—I think not, beyond the fact that we have never heard of any ill effects arising from boracic acid. I am not here at all as an advocate of the use of boracic acid. Only we are of opinion that boracic acid is very much superior to salt. But then, tastes vary very much. In some parts of the country they like a little salt still; in country districts they prefer what they term a brisk butter, which is another name for salt—2 per cent., say, possibly 3 per cent. We have been selling Australian butter from the first, and have never heard of any ill effects at all from boracic acid. The cases I mentioned just now of 2 and even 3 per cent. have come before us, and we have had to defend some of our customers in South Wales; all of the summonses have been dismissed on technicalities, which is not satisfactory, because we should be very pleased indeed to have a standard of percentage of boracic acid.

703. What would be the effect on your trade if the same restrictions were put on the use of preservatives as are in force in Denmark which amount practically to prohibition?—If boracic acid were prohibited, I do not think there would be a very great deal of difference; salt would be permitted, and the Australian manufacturers would then resort to that. There would be no practical difference, I should think. The introduction of Australian butter has very seriously interfered with the Danes. They ran the price recently up to 140 shillings a hundredweight, wholesale, that is, 1s. 3d. a pound, and it has dropped now 25s. a hundredweight in consequence of large arrivals of Australasian butter. Hence you may see what we should have to pay for our butter but for the Australasian colonies; it makes a great difference to the Danes, but then they have had a splendid innings, and have become very wealthy out of England.

704. They deserve it, I think?—I quite agree.

Mr. JOHN CARY LOVELL, called; and Examined.

Mr. J. C. Lovell.

705. (*Chairman.*) You are the Chairman of Lovell and Christmas, Limited?—Yes.

706. And you have been engaged in the butter trade, I think, for a long time?—Ever since 1852.

707. You are great importers of butter?—People say we import more than anyone else in the trade; we do some 350 to 400 tons a week.

708. That trade, I suppose, has been greatly developed of late?—Very much.

709. Are there any particular causes for that?—One cause is that we are able to bring fine butter from greater distances than we used to do. We get better transit, and by the use of the preservatives we get a fresh butter on the market here in perfect condition, whereas in the old days we could not do so.

710. By the old days, do you mean twenty-five years ago?—Yes, or even later than that. There has been an enormous development in the last twenty years or fifteen years, and it is continually going on, you know. People require the butter fresh and unsalted as much as possible.

711. Previous to that did you bring any butter from Australia?—We could not do it.

712. From America?—Yes, from America, but never successfully. The American butter spoiled in transit—it became rancid, especially on the outside of the packages.

713. Then your trade was practically confined to the continent of Europe?—We have been bringing butter from France—I scarcely like to charge my memory as to how many years—but my first visit to France was paid in 1859. Then we were bringing salted butter from Normandy; we did not bring fresh butter in those days.

714. Now the use of salt has been superseded, to a large extent, by modern preservatives?—That is so.

715. Are these preservatives generally boracic acid or borax?—We have never used anything else.

716. Is all the imported butter that you handle treated with these preservatives?—I think I may say that nearly the whole of it is.

717. Including the butter from Denmark?—Yes, including the Danish butter; but I must tell you that we do not bring fresh butter from Denmark—we have never been able to do it successfully.

718. Do you mind telling us why?—When the Danish butter was introduced they did not use any preservative in it, and it does not stand as well as the butter that we get from Normandy. I ought to explain this question of the preservative, perhaps, to you. We have minimised the quantity of preservative that is used to the smallest possible extent; it has never been used with the idea of increasing the bulk, but simply as a keeping property. The small quantity that we recommend and use is sufficient to keep the butter sweet, say, for two or three days, you know.

719. When you say "the quantity that we use," does that mean the quantity that your consignors use?—Yes, but we strongly impress upon all our consignors that they shall not use over a half per cent.

720. You do?—Yes. In 1891, I think it was, if I remember rightly, there was some little question arose as to the use of preservatives. It came up with us on that occasion in reference to the butter that we exported to Buenos Ayres, or to Brazil, I should say, principally. The Brazilian Government objected to the use of preservatives in the tinned butter that we exported there. Up to that time we had never heard any question as to there being an objection to the use of a moderate quantity of preservative, but directly that arose we consulted some of the very best people that we could find in the country—amongst others, Dr Stevenson, and, indirectly, Dr. Odling and several others—I cannot remember the names—but I think I have given you some of the names in my synopsis, and you will probably have some of these gentlemen before you.

721. I see you also consulted Dr. Redwood?—Yes. Dr. Redwood I know was one, and I think Mr. Hehner. We submitted samples of the butter to Dr. Stevenson that we were actually selling to our customers. We sent him a packet out of a consignment; he tested it, and he reported on it that the quantity we were using was quite satisfactory, and not in any way injurious. I only mention that. I understand he is coming here, at least I have heard so, so I do not want to go further than to say that we consulted him, and that we considered that we had his sanction as to the quantity that was contained in the daily butter that we were selling. Then we got our consignors in France to submit the butter again to the principal people in Paris. I forget the actual name of the place where these things are managed for the French Government. There they pronounced on it as being perfectly harmless, and the Minister, M. Tirard, actually sanctioned the use of the quantity that our people used. That was in 1891. We have continued to use that quantity ever since, and we advise all our people in Australia, New Zealand, the Argentine, and Ireland, wherever we get butter from, to use half per cent. of the preservative—that is, a half a pound to 100 lbs. or hundredweight.

722. Would you advocate the Legislature interfering to prohibit an excessive use of a preservative?—Most decidedly I would. Whilst this quantity has been ascertained to have been perfectly harmless, I think to overdose the butter with a large quantity would be absolutely wrong. I am afraid that it has been used in some cases very largely.

723. With what purpose?—You see, if a very large quantity were used, it would kill an ill flavour, to a certain extent, whereas the small quantity of a half per

Mr. J. C. Lovell.

16 Nov. 1899.

cent. is not perceptible. I myself could detect two per cent. or one-and-a-half per cent. at once.

724. What I wanted to ask was, what would be the object of any dealer or manufacturer overdosing his products?—In the first place, he would destroy, to some extent, the bad flavour, or kill it, with the boracic acid, and would prevent the development that had already begun of a bad flavour—he would prevent its developing as quickly as it otherwise would develop.

725. Would it arrest putrefaction if it had once begun?—I do not speak as a chemist—I can only speak of what I have actually seen before my own eyes in my experience as a butter merchant. But I may tell you this: The quantity we use in the Normandy butter—this half per cent.—is sufficient for us to keep the butter, I should say, practically three days—and in that time it is on your tables. We really do the business so rapidly from Normandy that the butter which is bought in the Normandy markets on Monday is in the hands of our shopkeepers on Wednesday morning. Half per cent. is ample for the purpose.

726. I do not want to put your evidence in conflict with that of any other witness, but we have had it in evidence that the Normandy butter, with the addition of the half per cent. of preservative, is more difficult to keep than the Danish butter without this preservative. Does that agree with your experience?—It is ridiculous. I have all these articles through my hands; there is not any country that produces good butter that I do not import butter from, and I cannot conceive that any man who has a good experience of the article would say that. I am in it every day of my life, and I suppose I smell and taste more butter than any man in England.

727. The Danish butter is drier in quality, is it not, than the Normandy butter?—A great deal of the Danish butter is pasteurised, and in my own opinion and by actual experience, pasteurisation has a very pernicious effect on the butter. It certainly tends to prevent its going rancid as quickly as it otherwise would do, but it destroys the fine flavour of the butter. We were getting a lot of the pasteurised butter from New Zealand from some of our factories that we sell for there, and we were obliged to stop it. You know, I daresay, that the New Zealand butter comes frozen; it could not be brought but for that. When the frost gets out of the pasteurised butter it goes off—what we call "salve"—insipid; whereas the natural butter, with half per cent. preservative and frozen, does not, but retains its flavour. I can show you butter with half per cent. of preservative that was made in New Zealand in February last, which is in the cold air store now, that has the full flavour, and is as sweet as any butter that is made to-day. But it is not so with pasteurised butter.

728. Some of the Irish milk is pasteurised before butter is made, is it not?—I do not know. In my opinion pasteurisation is a great mistake, and all my principal people in the Colonies are giving it up. We do not do it in the Argentine. We are importing at this moment some of the finest butter ever seen from the Argentine. We have stopped the pasteurisation everywhere where we have any control of the matter.

729. Yet the Danish butter had a very high character?—In the opinion of a great many people the Danish people do not send as fine butter now as it was before they took up with this system of pasteurisation. You have had a gentleman named Hudson before you here, have you not?

730. We had him here yesterday?—He used to use entirely Danish butter for his best salt butter, but for the last two years he has done nothing of the kind. He gets a finer article from Normandy in the summer and he uses New Zealand butter in the winter—he boldly advertises that as being the best butter there is. I look upon this Pasteurisation as a fad of the Danish people which is going to cost them a great deal of money before they have finished.

731. Pasteurisation is not compulsory, I suppose?—No, not at all. It is an expensive thing, because it causes a great deal more labour in the manufacture of the butter.

732. The milk is raised to 170 degrees Fahrenheit?—Yes.

733. And then separated?—Yes, and that destroys the very fine flavour that you get naturally from the cream.

734. To pass to another branch of our inquiry: Can you tell us anything about colouring matters?—Yes. As far as colouring is concerned, if it were not that certain parts of the country will have these articles coloured I should rather see it was not used. But it is a positive fact that in many districts you cannot sell these articles unless they are coloured. Manchester, you know, requires a light coloured butter—they will not have a very high coloured butter. Then you go into the Midland counties and into the West, and there they will have colour. If you offered those people a sample of butter that is pale and of a natural colour, they say, "Oh! it is lard; I won't have that stuff; I won't have it at all." We have actually had butter imported into this country without any colour at all—almost white—in the winter season, as it would be from stall-fed cattle, you know, and we have been obliged to have it re-made with the addition of a colour in order to sell it. The same with cheese. There are certain districts which will have coloured cheese. We have to get a certain quantity of cheese coloured in Canada of a much higher colour in order to suit those particular districts.

735. Manchester, you say, likes pale butter?—Yes.

736. But it likes a high-coloured cheese, does it not?—Not particularly.

737. They make us colour the Scotch cheddars?—They do colour them, and they colour them very highly in some of the districts. In the Midland counties, and even about in the country places, in Kent and Surrey, they want a lot of colour; and yet we could not sell cheese for the London trade of that particular colour. Of course, you know that the colouring matter is used just as much in this country as it is in other countries. Ireland uses colour. Speaking about the question of fresh butter, it would be impossible to bring fresh butter from Ireland to put, say, on this market here, saleable to the public and sweet, especially through certain months of the year, unless we could use the preservative. We never could do it until we used the preservative. Now, by the use of the preservative, we bring a quantity of fresh butter from Ireland which just holds the butter sufficiently long to get it into consumption. The texture of a great deal of the Irish butter naturally is of a weaker body than that of many of those other butters.

738. Have you followed the subject far enough to form an opinion whether that arises from the quality of the pasture or from the breed of the cows?—I think it is more from the feed that they eat.

739. That is the quality of the pasture?—Ireland is a wet country—as a rule they get a great deal more rain there. I say so because, in dealing with the Dutch people, we can almost tell the weather they have had in Holland from the butter when it comes here. If you get a cask of Dutch butter when they have had very wet weather it is very sloppy, and they cannot get the water out of it. If they have a drought for two or three weeks, or very dry weather, you will have the butter as solid and as firm as possible.

740. Is that butter passed through a factory?—I am speaking of either factory butter or the ordinary farmers' butter. Both will suffer in the same way, but it is particularly the case with the farmers' butter, that the butter which is made in this wet, sloppy weather will not keep as the other butter will.

741. (*Professor Thorpe.*) You said that you are now able to import Irish fresh butter, whereas formerly that was not the case?—We could only bring it as salt butter, and it had to be very highly salted in the old days for it to keep.

742. But there has recently come a very considerable improvement in the manufacture of Irish butter, has there not?—A very great improvement.

743. Has not that something to do with the change that you speak of?—You mean in the feeding or in the use of the preservative?

744. I mean that the butter itself is much better made of late than it was at the time that you are referring to?—I must say at once that there is an improvement in the make of the butter. The dairy schools that have been established over there have done a great deal to improve the butter making, and the bringing of it to market much quicker, has had a great deal to do with the development of the trade. You see in the old days the farmer packed his butter in a cask as he made it, and many of them could not make a cask of butter except at several makings, and those were put in, one over the other, and heavily salted in order to keep. By the establishment of markets, as we have done, in various

Mr. J. C. Lovell.

16 Nov. 1899.

parts of the country, we are taking butter day by day as they make it; then it is taken into the factory and milled every day as it is taken from the farmer in these local markets. It is milled with the addition of this half per cent. of preservative and a small quantity of salt, and then it is sent away that same night to London. Consequently we get a constant stream of it coming quite fresh, and that has revolutionised the trade in Ireland.

745. But the point is, that those subsequent processes through which the butter has been put have improved its character?—Yes, they have.

746. They have made it more uniform to begin with?—Yes, and even if they had not made it more uniform the fact of getting it to market so much sooner, you see, helps the thing.

747. That, no doubt, has helped; but the incidental processes through which it has been put before it goes to the market have also tended to the improvement in the quality of the article?—That is so. I may tell you that all about Killarney and Bantry, and out in those western districts there, they still follow the old modes of making; but by taking the butter from them daily as it is made—instead of their keeping it a week before it is put on the market, and perhaps fourteen days before it gets to London—we get it here within three days, and that makes a tremendous difference. Then, again, up in Armagh and Derry, and all away in those districts, it is done in the same manner. You will see the farmers or the peasants coming in there; one will bring 6 lbs. of butter, another will bring 20 lbs.—we receive from 6 lbs. up to 50 lbs., which would be a large lump of butter to bring in. Some of them will bring in 6 or 7 lbs. Now, you can understand that if the man who makes 6 lbs. of butter is going to keep that until he has got enough to fill a package the first makes will be spoilt. That is the thing that has done so much to improve the Irish business. But then, even so, unless we had a preservative we could never bring it quite fresh. We tried it over and over again, and spoilt no end of butter. When we first started the factory at Killarney and at Bantry we tried bringing fresh butter without a preservative, and invariably it became rancid within forty-eight hours.

748. In other words, you tried to do what the Danes had been doing at that time?—Yes.

749. That is, to introduce it into this country without the use of preservatives?—Yes. If it were not a useful or almost a necessary thing, in order to put a sweet article before our customers, instead of a rancid one, we would not wish to use a preservative at all.

750. I quite understand that, but I cannot yet quite understand, considering that Ireland is at least as near to England as Denmark is, if the Danes can throw into this country such a relatively large amount of butter without preservatives, why the Irish cannot do it?—I think I can explain that to you. In Denmark butter making is a scientific business, it is followed there as such, and there are very large dairies, which may make from either four or five casks up to fifty casks in a week. Then they have large factories and proper machinery and refrigerators and all sorts of things to do the business properly. In Ireland it is all made amongst the little people, who keep their two or three or four or five cows, and it has to be collected in small parcels and then put together afterwards. That is one of the reasons why Danish butter in bulk beats the Irish butter, and it always will beat it whilst the present system is going on in Ireland. I have one lot of butter that comes from Denmark from one gentleman, and I often have sixty or seventy casks in a week, and rarely at any time of the year do I get less than forty hundredweight-casks from that one particular man, all made up by his own people. I have another in Sweden, whose butter I have had for years regularly, and he sends almost an equal quantity. That is shipped from Gothenburg.

751. (*Chairman.*) There are a good many small dairy farmers in Denmark who send their butter to factories, are there not?—It is just possible. I know that in some places where there are small farmers they send the cream—they do not send the butter made, but they send the cream into the factory, and then it is worked on the factory principle, in the same way as it is in New Zealand and other countries.

752. (*Professor Thorpe.*) You have just mentioned Scandinavian butter; does that contain preservatives?—Some, I believe, does not, but some does. Wherever we have to deal with it, we advise and insist, as far as we can, that half per cent. should be used. We find the effect of that is that we never have any bad butter—we never have any rancid butter.

753. This is from Sweden?—Sweden and Denmark.

754. I have done with Denmark, and I am dealing now with Sweden?—Yes. Of course we cannot force people to use it, but we strongly recommend them to use it.

755. Then there is no law in Sweden against its use?—I do not know of any; I have never heard anything about it.

756. Are you aware whether there is one in Norway?—No. There is very little butter brought to this country from Norway; it is a very small importation.

757. It is an increasing amount?—Yes, it is just beginning to move, but it is very small. There is a good deal more from Finland.

758. You are not aware whether there is any law against preservatives in Norway?—I am not aware.

759. May I tell you that they have adopted the Danish system, and that they forbid it?—That, I presume, is for home use.

760. No, it relates to that which comes over to this country?—Perhaps I may tell you something about other countries who have laws against the use of preservatives in butter, but yet do sanction it for all that is to be exported.

761. I was going to ask you on that very question as regards France; the French are very stringent on the matter of preservatives, are they not?—I do not want to tell you anything that is detrimental to my business.

762. I should not like to ask you anything of that kind, but may I ask you on a point that you yourself have stated, namely, that the exportation of butter containing boracic acid was sanctioned from France?—I may tell you that the French Government at one time absolutely prohibited the use of preservatives for all butter manufactured in their country; but when it was laid before the Government there by those who were interested in the dairy industry, that it would be a fatal blow to the commerce of the country—well, I may finish that by saying to you that our butter that comes from Normandy contains a half per cent. of preservative.

763. I think that is all I need ask you on that point?—You will understand.

764. I quite understood it before, as a matter of fact, but I thought I should like to have it down if possible?—I do not know anything that could do the butter business more mischief than to stop the use of a moderate quantity of preservative. I am certain that it would prevent at least 30 to 40 per cent. of the fine fresh butter that comes into this country coming here, and it would also cause what we could get hold of to be worth 3d. to 4d. a pound more. I cannot conceive that that would be an advantage to the public.

765. (*Chairman.*) Let us have that clearly—does that 40 or 50 per cent. apply equally to Irish butter as well as to foreign produce?—I should never think of bringing Irish fresh butter if you stopped the use of a preservative. I should cease instantly. I should bring it all salted, because I have lost so much by it in late years. I have tried every means in my power to bring the Irish fresh butter to market, unsalted, without a preservative, and it was a continual loss.

766. (*Professor Thorpe.*) You have no reason to suppose, have you, that by further practice in the Danish methods in Ireland a still further improvement in the quality would result—such that the use of preservatives could be obviated?—I am as certain as a man can be of anything that it could not be. I think if you were to be engaged in looking at the texture of the two butters, one against the other, you would come to the same conclusion yourself. Every country's butter more or less has a different texture. You will think perhaps it is a curious thing. We get splendid fresh butter from France, and keeping to a certain extent without anything—that is, for a moderate time. Then, at certain times of the year in Belgium they cannot make a butter that will keep at all. Some noblemen in Belgium have spent thousands in starting what are called the Union Dairies there in order to make butter on their own estates; but they cannot make it of any solidity and substance in Belgium—it invariably fails. They make a moderate butter, but it never has the body or the substance that some other butter has, and they have had Danish makers in the country to make it. These gentlemen I know intimately, and I have been endeavouring to help them for years past to bring this thing to a success. The same people that put up our refrigerating apparatus went over there and put up a

Mr. J. C. Lovell.

16 Nov. 1899.

refrigerating apparatus at a large place at Bruges for the uses of cooling the butter, and also for their pig business.

767. I suppose the average amount of moisture which is contained in Irish and in Normandy butter is greater than in Danish butter?—Much greater.

768. Has that anything to do with the keeping quality?—It has a great deal to do with it.

769. Therefore, if these butters were made drier they would keep better?—Of course.

770. (*Chairman.*) But I think you have already given the opinion that the Irish butter could not be made drier?—No, I do not think you could ever get the Irish butter with the substance that the Danish butter has in it; you could not get so much of the moisture out of it. You, I daresay, have read the evidence that has been constantly produced before these Committees as to the quantity of water that is contained in butter. The Irish people are always standing up for a much higher standard of water; they stand up for a higher standard than is necessary altogether. I am having Irish butter analysed continually. We analyse everything. Mr. Hehner is our analyst, and we send him samples of everything that we have. I find that where in Normandy we rarely ever get beyond 11 per cent. of water in the butter, the average from Ireland will be about 13½. In our Irish factory, butter that we sell regularly and also in the creamery butter (I could show you copies of the analyses going over years) we never get up above 15 per cent., but it is generally about 13½, and at the very wettest time it will never get above 15, although people talk about wanting 20. That is wanted in order to increase the weight, in my opinion. My man, Mr. Warner, of Bantry, who was the pioneer of the factory system there, has written me repeatedly that to ask for 20 per cent. of water is to ask to be allowed to commit a fraud, "because I can prove," he says, "that it is not necessary, and mine is about the wettest district in all Ireland." You know that neighbourhood, of course.

771. (*Dr. Bulstrode.*) I do not think we have quite cleared up this matter of the difference between the Danish and other butters. I understood you to say in answer to Professor Thorpe that the Danes were able to send their butter into this country without any preservative because of the modern scientific methods which they adopted; is that so?—They send it as a salt butter successfully, but they do not send it successfully as a fresh butter.

772. Is one right in inferring that if a country which is equally distant from England, such as France, Belgium, Holland, and Ireland, were to adopt the method of the Danes, we could be supplied with such butter, not fresh we will say, as is supplied from Denmark?—No, because the country will not allow it to be made. You cannot make butter in Belgium as solid as you can make it in Denmark. My own opinion is that it has to do with the pastures to a very great extent. Any man who knows much about butter making will tell you that according to the food that the cattle have, and the nature of the land that they go on, so will be your butter.

773. Then, to put it in another way—the butter produced in Denmark is of such a quality that it, alone of all the other butters near and round about England, can be imported into England without preservatives?—I should say that and Swedish butter are the most likely, and would stand longer than almost any other butter. There is another butter that would stand, which is made even more solid now than Danish butter, and that is the butter in the Argentine. That again comes entirely from the pasture. I suppose that the finest butter that comes to London through the winter months is the refrigerated butter that comes from the province of Auckland. It makes the highest price of any imported Colonial butter. It is made at Auckland in our farm there. We sent the principal of our factory in New Zealand to the Argentine to make butter there, and he had not been there a month before he said: "This is the finest place, I should think, in the world for making butter. I shall make butter here better than the New Zealand butter." And he has. He sends us butter that is absolutely without liquor, and is as solid as possible. You gentlemen are interested in butter, and I should like you to pay a visit to my place. I would show you these things, and seeing the thing goes infinitely farther than anything I can say to you.

774. How much preservative is there in the butter of which you have just spoken?—Half a pound to the hundredweight of butter; it is really less than half per cent. If you analyse it it never comes out to more than about 0·4 per cent.

775. Do you have the butter from these places analysed for boracic acid from time to time?—Continually. I do not know whether Mr. Hehner is likely to appear here, but he can tell you our procedure with these things, and how careful we have been always to prevent any excessive quantity being used. We are constantly sending to him. If we have the slightest suspicion of any butter we send it to him at once to report on it.

776. Would it be possible, in your opinion, to introduce butter into this country from New Zealand without the use of preservatives?—We should spoil half of it.

777. When would it spoil?—I will tell you. I am very glad you gave me the opportunity of mentioning that. All the factories dotted all about the country cannot keep a refrigerating apparatus themselves; you will quite understand that, because they are, in fact, big stores to put up. Say there is a factory thirty miles from Rangitaiki; there is a freezing place there, and that butter has to be made and carted off to this freezing place. If there was not a small quantity of preservative in that butter, in hot weather such as they get there, in all probability in that butter deterioration would have commenced on the outside portion against the wood and the paper, and then, although going into the store and notwithstanding the freezing, it would be rancid on the outside—not in the centre of the block, but all round the outside. If you could freeze it the moment you have made it, when the butter is completed, and keep it so without ever letting it get above the freezing temperature, you could keep it a long time; but still then when you take it out of the store to put it into consumption it will go quicker.

778. How quickly—have you heard?—I should say that in twenty-four hours you would find a change in it.

779. In what sort of weather?—In weather when we get a temperature of 67 degrees.

780. In very hot weather?—That is not very hot.

781. In hot weather we will say?—In hot weather it will go very rapidly.

782. Do you think that any butter is introduced into England without the use of preservatives?—I should be very much surprised to hear that there was any.

783. You have stated, I think, in your evidence, that the preservatives would kill a bad flavour in the butter?—If you take a butter that is perfectly sweet, and you give it a half per cent. of preservative, that butter will remain sweet in the hottest weather for three or four days; but that same butter without the preservative would be rancid in twenty-four or forty-eight hours. Then if you take a butter that is of an inferior quality, but has not absolutely turned, but is on the point of turning, which you can detect if you are a judge of butter, "This is going," you will say; but if they add a large dose of preservative to that you would not detect that bad flavour, but you would smell the preservative.

784. You would smell it?—Yes. If you were to give me butter with anything over one per cent. of preservative in it I should tell you directly. I could smell it. I should say: "You have too much preservative in this. It is so palpable."

785. You can detect anything over 1 per cent. by taste?—Yes, over 1 per cent. I have repeatedly sent a sample of butter to the analyst for that reason. A new sender, perhaps, has shipped us some butter, and I have said: "There is too much preservative in this; send a sample down to Mr. Hehner at once." It comes back: "It has 1 per cent. or 1¼ per cent. in it." We telegraph the man at once: "You must stop this; we cannot have more than half per cent."

786. You would really be able to detect the partial decomposition of the butter by the taste and smell produced by the boracic acid?—No, I should not detect it as quickly, because we should taste the boracic acid; later on it would come.

787. I meant, suppose a partially decomposed butter had 1 per cent. of boracic acid added to it, and you tasted it, as I understand you, you could not tell that it was decomposed, but you would tell that it had 1 per cent. of boracic acid in it?—Not so much. I should not be able to tell the full amount of decomposition as I should be if it had not the boracic acid in it; but if there was a very large dose, and I have found 2½ per cent. in, I could easily detect the boracic acid.

788. In a partially decomposed butter?—In a very bad sample of butter. I knew the people who made this butter; it was sent from a common district in Normandy, and dusted with this preservative. I took it upon myself to draw the attention of the people to the fact that they were using this and that it would be likely to cause trouble, because I considered it was wrong to use it. I have always held the opinion that a large quantity of it ought not to be used.

789. Then in actual practice it is used by some more or less unscrupulous persons to veil the partial decomposition?—I think that at one time it was used to conceal the quality of the butter that was becoming decomposed; but that, I think, has been, to a very great extent, remedied, because those of us who are interested in keeping the trade in a wholesome and sound way, wherever we have found anything of that sort, through our Butter Association and through the Chamber of Commerce, we have communicated with the people on the matter.

790. You had a large number of experiments made by your analyst with regard to the amount necessary to keep butter fresh, I understand?—Yes.

791. And as a result of those you say that anything over 0·5 per cent. is unnecessary?—It has not been necessary as far as we are concerned, and we do not sanction the use of it beyond that.

792. You do not prohibit the use of it—you do not refuse to accept butter which contains more?—We should; we should say at once we consider it is unnecessary and it is too much, and it may lead to trouble. Then we do not want to do anything that is likely to be injurious to anybody at all. We know that this small quantity is not. It has been sanctioned by eminent people, and we say that is the right thing to do, and to stick to.

793. (*Dr. Tunnicliffe.*) How long, in your opinion, would butter containing a half per cent. of boracic acid keep?—Apart from being in cold storage or anything of the kind, I consider that it holds the butter—that is the expression we use—for three days, and perhaps four, and in cold weather for a week; but in very hot weather, of course heat has all to do with these things—say you get a hot July or August day, then a half per cent. would not hold the best butter for more than three or four days.

794. But it would be quite impossible to get butter into the hands of the consumer in three or four days, would it not?—Butter made on Monday morning can be put on your table on Wednesday, and we do it—not only can we do it, but we do it every day. We have an arrival from Normandy every morning except Saturday, and in hot weather, in the summer, we have it on Saturdays, and we deliver to all the principal houses in London every morning before seven o'clock.

795. That is not usual, is it?—It is every-day work; it is going on day and night. I am importing 200 tons a week of Normandy butter, and it is nearly all fresh butter, and I never have any of it left after four o'clock on the day that it arrives.

796. (*Dr. Bulstrode.*) Then how long do you think it is necessary to keep the butter?—Following that out, we deliver the butter to the shopkeeper on the Wednesday morning, and he has to deliver it to his customers. Nearly all the people who consume the butter take two or three days' consumption, and they do not take it every day. By the process we adopt this butter remains good until they have finished it.

797. Which is, how long do you estimate?—I should say from three to four days, or five days perhaps.

798. If you can guarantee the butter keeping a week you can serve your purpose?—That is it.

799. By whatever method?—Yes.

800. With or without a preservative?—With or without a preservative. You must understand that it is one thing keeping butter in a cool place in a refrigerator and another keeping it in somebody's hot cupboard.

801. (*Dr. Tunnicliffe.*) All your butter, whether it is Normandy butter or Danish butter, or Argentine butter, or whatever it is, is all in the hands of the consumers in about three or four days after it arrives?—I was speaking of fresh butter from Normandy. That is why we reckon we cannot do it with fresh butter from Denmark—we could not do it owing to the distance.

802. I am speaking of the moment it arrives?—The moment it arrives we put it into consumption. I cannot hold it. We have cold stores of colonial butter. We can store about 600 or 800 tons of colonial butter in our place, but we do not store Normandy butter or fresh butter. That goes as fast as it comes—the very moment. We open at six, and we are taking in at one door and delivering at the other; as fast as it comes it goes.

803. (*Dr. Bulstrode.*) Do you think this butter, treated with preservative, goes off at the end of a week?—Any butter would at the end of a week.

804. With or without a preservative?—With or without a preservative; the quantity of preservative we use would not hold it more than a week.

Mr. J. C. Lovell.

16 Nov. 1899.

805. What do the retailers do who have got more on hand than they can get off on to the public?—They do not keep it so. We supply every day in the week. The smallest retailer would get it two or three times a week, and the large ones every day. In the case of Hudson's we deliver to all their branches every morning; all the Home and Colonial Stores have it four times a week, Cadbury's in Bond Street every day, and all the big people in the same way.

806. (*Chairman.*) Have you any experience of other preservatives besides boracic acid and borax?—A slight experience, but that is the only one which, to my mind, answers the purpose, because this form that we use is absolutely, or practically, tasteless in a small quantity, whereas nearly all the other things leave a flavour behind them. Formaline was one thing that was talked about. We have never used it, but we have been advised by chemists that it was very injurious. Another thing was at another time brought up and recommended very strongly, but I forget the name of it; it was commonly advertised about as being a preservative for butter, but we did not use it. We have never used anything but this, and we have used this almost from the first. The margarine people use this. At one time we spent a lot of money—ourselves and two other firms spent nearly £500 in operating on boracic acid and borax to get it flavourless—to get the very best preparation that we could possibly get made of it, and it is made of that now to this day.

807. We have had it in evidence that the preservative is not mixed with the Normandy butter, but that the butter is merely wrapped in cloths saturated with the preservative. Can you corroborate that?—No; I can tell you that the practice of saturating the cloth wrapper in a solution of borax and boracic acid was a thing that I instituted myself years ago. That was the first thing that we did in order to preserve French butter before it was used in the butter itself. We found that a very useful thing, instead of the cloths being put on with the dressing that is generally found in this thin stuff that they used to give us, which would appear on the butter, and stick to the butter, and often give it a white appearance, and the cloth, you see, would be almost transparent then. We thought that was injurious, and we got our people to saturate the cloths in a solution, first of all, of salt and water, brine, and then afterwards, when boracic acid and borax became known, we asked them to do it in that, because it took away the stiffening that they put in the muslin stuff, and prevented the cloth injuring the butter in any way, and I believe helped to keep it sweet; but it would not be sufficient to keep the butter.

808. (*Professor Thorpe.*) Is that not practised now?—Yes, we practise it with our cloths. It is a very little solution that is used; it is more to get the dressing out of the cloth. It renders the cloth quite sweet. A great deal has been said about the effect of this preservative on the human frame and constitution; if I might be able to give you a little personal example before I leave I should like to do so.

809. Certainly?—I have been in the business ever since this article has been used, and I think you can ask anyone in the trade in London whether there is anybody likely to have eaten more and tasted more butter, charged with boracic acid, than I have. My family eat butter at every meal, and we have it always on the table. I do not believe there is anybody consumes in a family more butter per head than we do. I have brought up a family of seventeen children; I have never lost one, and I have sixteen grandchildren, and never lost one of them. I do not think I am a bad example of what this quantity of boracid acid can do. I have had 45 years' business in this butter trade, and if that is not a fair example of trying it on yourself, then I do not know what is.

810. (*Dr. Tunnicliffe.*) May I ask you how much butter you consume a week in your family?—I could give you that exactly if you wish it.

811. I mean roughly—it is a personal question?—I think at the present time, taking those that are at home, we consume about 15lbs. a week, but I cannot give it you exactly by reference.

812. Probably a pound a head?—We have not fifteen at home now. A lot of them are married, and some of them are away at schools. We have all the young ones at home. My youngest child is five years of age, and I

Mr. J. C. Lovell.

16 Nov. 1899.

think it would surprise you to see the quantity of butter they eat.

813. (*Chairman.*) I suppose they all get as much as they want?—As much as ever they like, and they like it. It is this Normandy butter that they always have.

814. (*Professor Thorpe.*) Many of them are at the bread-and-butter age?—I have five of them at home, and the eldest of the five is nine. I have never had the misfortune to lose a single child. I have seventeen living, all healthy and well, so it is a pretty good criterion.

815. (*Dr. Bulstrode.*) Do you eat many other things in the course of the day which are likely to contain boracic acid?—I always take a glass of milk every morning directly I get out of bed. I am a great milk drinker; but I do not know whether that gets boracic acid in it, I suppose it does. I do not know, but I always have it, so does my wife, and my children drink no end of milk. I am a great believer in these things for children. I do not think there is anything in the world better for young children than plenty of bread-and-butter. If you, gentlemen, would like to see what butter is in its various stages, and the different makes of butter from different countries, if you will pay me a visit in the City, I think I can show you nearly everything that comes. We have it in cold air store as well as the other way, so if it is a matter of curiosity to you, or if it will help you in your enquiries, it would be quite at your service. Some analysts have visited us, and seen these things at various times.

Mr. J. Riley.

Mr. James Riley, called; and Examined.

816. (*Chairman.*) You represent the Liverpool Chamber of Commerce, I believe?—Yes.

817. Are you a partner in the firm of Willer and Riley?—Yes; Willer and Riley, Limited, it is really now.

818. Are you importers?—Yes, of butter and provisions; our principle importation is butter.

819. Can you speak as to the use of preservatives in butter?—Yes. We have had a great deal of experience regarding the keeping of different classes of butter. A great deal depends upon the way in which butter is made. If butter is made on the latest scientific principles, then there is not the slightest neecssity for any preservative matter to be added. In Denmark, for instance, they make butter on the latest scientific principles, and use every possible care in the making of the butter. Preservatives there are forbidden; they are not allowed to use them; and our experience has been for some years past now—and I suppose we are one of the largest importers of Danish butter in England—that it keeps quite as well, if not better than any other class of butter. But this is principally owing to the Danes pasteurising the cream, which is, of course, rather a costly method. There are other countries which do not use preservatives. I suppose in Canada they are not allowed to use preservatives; and that is also a butter that keeps very well, but still the butter there is made also on scientific principles, and the managers of the dairies there are well posted up; and well educated in regard to the manufacture of butter.

820. Do they pasteurise in Canada?—Yes; I believe they pasteurise in Canada. Take Ireland. Preservatives are used rather extensively there, particularly in what we call the secondary class of butter; we have there a butter which they call a factory-made butter, that is, butter which is collected by a merchant from the different farmers. It is an unsalted butter, and the farmer takes it to the factory where it is re-blended, that is, it is all cut up, really, and put through a machine and blended and salted. If preservatives were not allowed to be used in that description of butter, it would not keep more than three days, it would simply kill the trade, and that is rather an important trade in Ireland. It is butter that is sold at about 1*d.* to 2*d.* a pound, roughly, less than the choicest butter; but it is a butter that is really wanted and really necessary amongst a certain class of people. We have tasted that butter. We have had butter which has been tasted, in fact, I have tasted it myself in the factory, when it has been perfectly fresh, and without any preservatives added; the butter has been nice and sweet. We have had that butter sent over to our warehouse, and and three or four days afterwards it has been almost unfit for sale; it has gone off so quickly.

821. You are speaking of factory butter, are you?—I am speaking of factory butter. As regards what we call the creamery butter, I believe a lot of creameries here do not use preservatives at all. The fact is that the butter has very often, particularly in the hot weather, to be sold, I should say, at least at 5*s.* to 10*s.* per hundredweight below the price of Danish, simply owing to the butter not keeping. They have not the means there of pasteurising the cream, and it is not made on the latest scientific principles, like it is done in Denmark and Sweden.

822. You are talking of certain creameries, I suppose?—Yes, not of all. I believe some of the creameries do it—for instance, the creameries in connection with a large firm in England, the Maypole Dairy Company. They have a certain number of creameries there. They Pasteurise their cream, and do not use any preservatives at all, and therefore it keeps; but a great number of the co-operative creameries do not pasteurise it at all.

823. Do you approve of pasteurising the cream?—Yes, decidedly.

824. You do not think it impairs the quality or flavour of the butter?—No, not at all; in our experience it is just the reverse—it improves the quality.

825. That is not the universal experience of your trade, is it?—Well, that is our experience, and I can only speak of what we find ourselves.

826. We have had the opposite view put in evidence before us?—We have had a very large experience as regards that. We distribute a very large quantity of butter all over the country, and of all descriptions of butter. We have butter from almost every country in the world. We certainly do not sell much butter in the South of England, and I am speaking now more of butter in the North and Midlands. There Danish butter which is pasteurised will always bring a higher price than any other class of butter. That is a fact which I think no one can dispute. That is as regards the North and the Midlands.

827. You do not include in that comparison Normandy butter, I suppose?—No. That is a class of butter that really will not sell in the North of England. There is scarcely a ton of butter sold, in two months, of Normandy butter there. It is a butter that is sold entirely in the South of England.

828. Do you import any Australasian butters?—Yes; we import Australian butter and New Zealand butter also.

829. Have they any preservatives?—Australian butter has, New Zealand butter has not; but that is also a class that is not sold very extensively in the North, it is nearly all sold in the South.

830. The New Zealand butter comes in cold chambers?—Yes.

831. Fresh?—Yes, fresh.

832. Without any preservative whatever?—Yes.

833. And no percentage of salt?—It contains a certain percentage of salt, but I do not think the salt is added to it as a preservative; it is added more to suit the taste of the certain district. For instance, take Danish butter, we add salt to it; for some parts we have to add as much as 2 per cent. of salt, and for some parts only 1 per cent. of salt, but that is not done with the idea of keeping the butter. We have had absolute proof that Danish butter where there has been absolutely no salt whatever added, has kept quite as well as butter with 2 per cent. of salt; we have tested that ourselves. The adding of the salt is done more to suit the taste of the people. In the North of England they like what we call a "smack" of salt in the butter, whereas in the south, as a rule, they like it quite mild.

834. (*Dr. Bulstrode.*) What is your evidence that the New Zealand butter you are speaking of contains no preservative other than salt?—We have been instructed by one or two agents that we have out there that they do not use it at all.

835. Have you had it tested on its arrival in this country to ascertain really whether any preservative is put in?—No, we have not. I am only speaking from what our people in New Zealand have informed us; we have not clearly examined and tested it to see that.

836. Suppose you did test it, and found that there was boracic acid in this New Zealand butter, your views would be to some extent altered in reference to the necessity of preservatives, would they not?—I do not know that; I should want to know first of all how the butter was made. I do not altogether disapprove of preservatives. My point

Mr. J. Riley.

16 Nov. 1899.

is that if butter is made on the latest scientific principles it is not necessary to add the preservatives.

837. Your point is that they are not necessary, and one reason for their not being necessary is that you say that butter can be sent from New Zealand without any preservative?—Yes.

838. But you do not seem quite sure that that is a fact?—No. I am not speaking now from tests actually made on the butter; I am only speaking from what our agents tell us.

839. Do you know also whether preservatives are used in Canada in the butter which is supplied to your firm?—Our people there inform us that preservatives are not used. I believe the Government by Act of Parliament forbid the use of preservatives.

840. You quite approve of butter made from pasteurised cream?—Yes.

841. You do not think that any deterioration in taste or flavour can be detected?—No, not at all.

842. Do you know how long the Danes have pasteurised their cream?—I could not give the exact date; they have been pasteurising it for some years; how long I really do not know.

843. Do you think that the Danish butter is holding its own in the market?—Yes, decidedly so; it is not only holding its own, but in the North of England it is certainly superseding any other class of butter, and certainly the Danish butter will command amongst the retailers, as a rule, about a penny a pound more than any other descriptions of butter.

844. I speak more exclusively of the North?—I can speak more of the North than the Midlands.

845. You have no experience of the South?—I have practically no experience of the South.

846. Now, taking the New Zealand butter which you import without, as you say, any preservatives, can you tell us exactly how long, or approximately how long, it lasts after being taken out of the cold chamber?—I should think it will keep sweet for quite three weeks after being taken out of the cold chamber—that is supposing it is taken out of the cold chamber and is exposed in the ordinary atmosphere without being taken again into the cold chamber. We have experience where it has been good for about three weeks; it will be quite sweet for about three weeks.

847. In what sort of weather?—In almost all kinds of weather; but really the only time of the year when we import that butter is in the winter months, and I would not like to say how it would keep in the summer months.

848. You only import it in the winter months?—Yes, Australian and New Zealand butter never comes into this country except in the winter months. It just comes when there is supposed to be a scarcity of butter here. It commences to arrive really about October, and finishes in April.

849. How long do you think practically for the purposes of trade it is necessary for butter to be kept?—I should say it is not at all necessary to have butter kept longer than from three weeks to a month, simply because there are such facilities now for cold storage. We have cold chambers, you might say, in almost every large town, and if people wish to keep butter all they have to do is to put the butter into the cold chambers, where it will keep absolutely sweet.

850. (*Dr. Tunnicliffe.*) Do you know of any other condition of butter than the presence of a preservative upon which its keeping apparently depends?—No.

851. All butters keep alike, except those that are not provided with a preservative, so far as you know?—A great deal depends upon the manufacture of the butter. If one butter is made a perfect butter, and the other is only made an imperfect butter, of course the imperfect butter will not keep like the perfect butter.

852. But given a sample of butter, from looking at it, or cutting it, could you tell whether it would keep, or whether it would not?—No, certainly not.

853. (*Chairman.*) Would the texture of the butter not be some indication of its keeping quality?—No, not at all; it would not be the slightest indication.

854. A soft butter keeps as well as a hard one?—Yes, I should say so—quite. I should like to mention that there is a distinction between a soft butter and a weak made butter. Butter can be properly and well made and still have a soft texture. This class will keep quite as well as a hard made butter. A weak made butter which is a badly made one will not keep.

FOURTH DAY.

Friday, 17th November, 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. CHARLES E. L. GREGSON, called; and Examined.

Mr C. E. L. Gregson.

17 Nov. 1899.

855. (*Chairman.*) You are Director of Messrs. John Morrell and Co., Limited, I believe?—Yes.

856. And President of the Liverpool Provision Trade Association?—Yes.

857. Your firm are pork packers and importers, I understand?—They are.

858. We have had a good deal of evidence about the pork trade; I suppose you confirm generally the information that has been given to us that the preservatives borax and boracic acid are much more used now than salt?—Yes. Thirty years ago boracic acid and borax were not used at all; about twenty-five years ago borax was used in a very small proportion; but since that time it seemed to grow from year to year. The public seemed to require those mild cured meats which could not be produced without the assistance of boracic acid and borax; and the trade is gradually drifting that way. The borax packing is really driving out the salt packing.

859. What proportion of pork carcases and sides are packed in salt now?—We have obtained statistics from the different importers, and the result of the investigation is that about 25 per cent. of American and Canadian meats come in salt and 75 per cent. in borax.

860. Are those that come in salt strong salted?—They are hard salted mostly for the Irish trade. The Irish trade generally does not seem to want a mild cured meat, they want it hard salted.

861. They have not got into the way of using the mild cured meat yet?—I think it is something in the cooking.

862. Do you anticipate that there will be a change in that respect?—The tendency seems to be growing that way even in Ireland. They are taking borax-packed meat now instead of salt-packed meat in certain districts; where two or three years ago they would not take borax-packed meat they are taking it now.

863. I presume you are familiar with the mode of curing and preserving in America?—I am. I had the charge of our packing house twenty-five years ago.

864. Is there much borax used in curing?—We have made inquiries from different packers, and, according to

Mr. C. E. L. Gregson.

17 Nov. 1899.

all the reports we have heard, they do not use it at all in curing; neither borax nor boracic acid is used in curing.

865. I suppose the bacon lies in salt for about ten days?—In salt or pickle. Some of the bacons and hams are cured in pickle, and borax is applied to the surface of the meat after it is cured.

866. In a dry state?—Yes.

867. Then when it comes to this country that would be washed off?—That is washed off thoroughly; it is generally washed in hot water with a stiff scrubbing brush, and particular pains are taken to wash the borax all off.

868. Why is that—because you think it would flavour the meat or be deleterious to the consumer?—Yes, I think that is so. If the borax was left on the meat I think it probably might affect the flavour a little.

869. Practically, you consider it is all removed?—Yes I think so.

870. In the washing?—Yes, if properly done.

871. I suppose the operation of transit is much simplified by the use of a preservative?—Yes, it would be. If you had to bring it over in salt to keep it in condition it would get very hard-salted. The application of borax seems to close the pores and to preserve it fresh without making it salty as if it were packed in salt; but if you had to bring it over in the condition of salted meat you would have to put too much salt on it, and the result would be that when it arrived here it would be too salt for the taste of the public.

872. Do you have less difficulty than formerly with the meat going bad?—In what respect?

873. By taint or fly-blow—corruption?—Yes, the borax drives away the fly. Of course, the meat is supposed to be cured before it leaves the curing-house, and it does not get tainted after that if it is cured properly. The application of the borax has a tendency to keep the fly out of it altogether. We suffered a good deal years ago from what we call fly-blow, but the fly seems to leave meat altogether that has been dusted with borax.

874. Have you ever any complaints from your customers against the use of this preservative borax?—No, not unless the man was in the habit of getting salt-packed meat, and through some mistake he had got borax-packed meat, and was not careful enough, perhaps, in washing the borax off. He might object to it a little, but that is about the only thing. Where a man is getting borax-packed meat, and he knows how to treat it by washing the borax off, there is no trouble.

875. What would be the effect on trade, in your opinion, if the use of preservatives was restricted or prohibited?—I think it would greatly curtail it, and as the public taste is now educated to the mild-cured meat I do not think the public would take it in its old condition. I think they would object to it. Their tastes are so educated up to that point now that I think it would greatly interfere with the consumption.

876. (*Dr. Tunnicliffe.*) You say in the proof of your evidence, "The use of borax as a preservative, as above indicated, has ever since its introduction been continually increasing." Exactly, what do you mean by this?—It started in an experimnetal way at first, and each packer shipped small lots, but meat so treated seemed to be growing in favour, and it has grown now to be about 75 per cent. of the volume of the business.

877. But the actual amount used has remained constant?—Yes.

878. Approximately one per cent.?—Under the one per cent. I think in the early stages some of the packers who were not exactly posted did put more than one per cent.; they used to sprinkle it a good deal like salt. That was where a packer did not understand what was required; that was in the experimental stages, and they altered it to about what we have now—one per cent. I think in the early days some of them used considerably more than one per cent., but there is really no necessity to use more than one per cent., and that is the general system adopted now.

879. How do you know that only one per cent. is used?—From the returns of the packers—each packer has made a statement that they use about one per cent.—and from my own practical experience; I have seen it packed where one per cent. has been put on, and I have seen meat coming forward each week, and if there was a larger percentage on the meat than one per cent. I shoul dbe able to tell from my own experience and observation that it would be more than that.

880. There would be a thicker crust?—Yes.

881. You get very little so-called tainted bacon now?—Very little.

882. You used to get a good deal?—Yes.

883. Do you know whether anybody has ever tried to bring over bacon with a less percentage of boracic acid than one per cent.?—I do not know.

884. You never heard of a half per cent., for instance?—I do not know that.

885. You do not know at all about it?—No. I should say it might be perhaps a little bit below, and some a little bit above, one per cent.; you could not, perhaps, tell to a fraction, but that is about the average.

886. But you know it has all been one per cent. or just over?—About that. As I say, in the early stages they used more, as some of the packers used to throw the borax on it just like salt, and then it forms a sort of cake.

887. For all you know they might be able to use less with the same result?—It is quite possible within a very slight fraction, but I do not think with very much less, because they are experimenting all the time, and borax is rather expensive. They do not use borax as a matter of economy, and they want to use as little borax as possible. They would use naturally from a commercial standpoint as little borax as possible to produce the same result. The question with the packer all the time is how little he can use and produce the result.

888. (*Chairman.*) What is the comparative price of borax and salt?—Borax, I think, is worth about 6 or 7 cents a pound in America; that is about 28*s.* a cwt., and salt would be perhaps 30*s.* a ton delivered.

889. (*Dr. Tunnicliffe.*) Do you know how long bacon boraxed to the extent of one per cent. would keep?—It depends a good deal upon the condition of the weather. It ought to keep in a reasonable kind of weather perhaps a month, but it is better if it is used fresh.

890. It would not keep longer than a month. It would undergo some change that would enable the trade or a connoisseur to tell after one month, would it?—I should say so, but it is better if it is used fresh; the fresher the better.

891. Have you been in America yourself?—Yes.

892. The pig is not in any way treated, is it—the borax is added in no other way than that which you have mentioned?—No.

893. Of that you are quite sure?—Yes.

894. (*Dr. Bulstrode.*) As far as I gather from you, the only difference between the salt-cured bacon and the borax-cured bacon is that one has boracic acid sprinkled outside and the other has not?—Excuse me, sometimes we get mixed in this way; it is all cured by the same process. It is a question of the packing, not of curing. Salt packing and borax packing is the distinction, but it is all cured in the same way. This question of the borax applies to the packing after it is cured.

895. I quite understand that, but I wanted just to get that point out; what is the precise object of packing in borax?—To preserve it mild, to keep it mild, as the public taste requires it.

896. In what way do you think it keeps it mild?—It prevents the slime. If you take it without salt or borax the meat gets slimy in transit. The borax has a tendency to close the pores and to keep it from getting slimy. If you applied sufficient salt to keep it from getting slimy and out of condition, it would then get very salty and hard salted.

897. Is the salt absorbed if you pack the hams in salt?—Certainly, a certain amount of it is.

898. Is the borax absorbed?—I do not think so.

899. How do you know it is not absorbed?—I do not know chemically that it is so, but my experience says that it is not from the quantity that is put on and from the taste of the meat after it is washed off. Chemically I do not know; I simply speak from a practical commercial point when I say I do not think it is. I could not swear from a scientific point that it is not absorbed, but my practical experience says that the borax has a tendency to close the pores, and I do not think much borax goes in.

900. Have you ever heard of any other method of treating hams or bacon with preservatives, either borax or boracic acid, than by the way you have described? You say from the inquiries you have sent out that, as far as you can ascertain, the method you have described is the only one used?—Yes, from information we have received.

901. Have you ever had any suspicion that there are

Mr. C. E. L. Gregson.

17 Nov. 1899.

other methods in vogue, not perhaps in connection with those with whom you deal, but in other parts?—No, I do not know that I have.

902. You have never heard of any method of forcing a solution of boracic acid into the vessels?—No; I have heard of pumping in pickle, and it is quite possible, though I do not know, that some of the curers may force some boracic acid in. I never knew they did, but they possibly might if there is any advantage in it; I do not know.

903. You never heard that that is done?—No, but I know that there is pickle forced in with the pump. Speaking from a commercial standpoint, we are not advocates of borax; we simply give the public and the trade what they wish, and it is immaterial to us in what it is packed so long as the people take it. We do not advocate the borax, only the trade requires it, and we are taking what the demand calls for.

904. Would it be possible to bring the dead meat over here, and deal with it over here instead of in America?—To bring it over and cure it here?

905. Yes?—I suppose it would be possible, with certain appliances. You would have to have refrigerator cars in America and refrigerator steamers. The whole thing would have to be handled in a refrigerator process, and then I suppose it could be done. That has been tried by small dealers, but it has been a failure. That has been experimented upon.

906. In what way do you mean a failure—commercially—Yes.

907. Has it been a failure with regard to the condition of the hams?—I think there is a certain amount of risk in bringing that meat over and in handling it after it gets here.

908. If that could be successfully done there would be no need for this borax?—I do not know about that. The matter of bringing over fresh carcases has been tried by several people that I know, and they have dropped it for some reason or other. Why they have I do not know, but I know several people have tried it, and they must have found it did not answer. What is the reason they dropped it I do not know, but if it had been feasible, as they were practical men, I should think they would have gone on with it.

909. (*Professor Thorpe.*) Would the cost of refrigeration all along the line affect the price materially?—I suppose it would to a certain extent. If you brought over the whole carcase you would have to bring the offal.

910. Do you think that is the real reason?—The reason of what?

911. Why the trade has been stopped?—I do not know.

912. (*Chairman.*) It would have to be carried in faster trains, would it not?—Yes, and the whole system refrigerated.

913. And that, of course, would add to the expense, would it not?—Yes, it would. Of course, a pig is not all bacon; there is a certain amount of offal in it, and before it is made into bacon it has to be cut up into different sections. I do not think it would be advisable to bring that over in such large quantities.

914. (*Dr. Bulstrode.*) You say that for the last twenty-five years no case of injury has come beneath your notice?—From the food point of view?—No, not that I know of.

915. Before that time did you have any cases under your notice?—No, not that I am aware of.

916. Do you think there was more tainted meat about in the old times, when you did not use boracic acid?—I think there was, but not from the fact that we did not use boracic acid. I think the improvement has arisen more from the fact that our methods have improved in comparison with what they were in those days. Take what you call summer curing; there was practically no summer curing in those days, and it was all cured in the winter. Then when what we call ice-curing, summer curing, came on they had to have different appliances, and they were not exactly posted what to do. The animal heat was not go out or taken out of the animal, and we had a good many miscures that way. As I say, I do not think the packing in borax or salt effects the cure, because it is supposed to be cured before it has gone wrong, and it is cured before it is packed in either salt or borax, and if the meat is not cured borax will not save it. It has to be cured before it leaves the packing house, because it has to go through different temperatures, and if it is not cured before it has left the place it taints in transit. I think the fact of its being less tainted than it was a few years ago is due to the fact that men understand the business now better than they did in the early stage of the business, and are more practical, and can be more assured of a correct cure.

917. There would probably have been more tainted meat, or approachingly tainted meat, eaten before the introduction of borax than after the introduction of borax?—I do not exactly comprehend.

918. There would be more tainted meat about before the method of treating by borax was introduced, would you say, than since?—I think there probably was, but I do not exactly think that it arises from the fact of using borax. I think the present methods are better altogether than those adopted in the early stages of the curing. There is this about it: If you are going to pack the meat in salt, and the curer knows that, he knows that if he cures it hard salted, and packs it in salt, it will get very salty, and, therefore, the tendency was before the borax was introduced to ship the stuff out from the packing house before it was cured, if you comprehend; the tendency was to want it mild, and before the meat was actually cured they would take a little risk and ship it too soon; they would ship it before it cured, and then the taint would develop in transit. Now they have a way of placing this meat before the public mild, and the curing process is completed before it leaves the packing house. I think probably there would be more tainted meat from that reason than from not using borax, because the inclination is to make the meat mild, even in packing in salt, and then ship it out in salt before it is cured, and then if it came through some warm temperature it would turn taint in transit.

919. (*Chairman.*) Tainting takes place before the curing is complete?—Yes.

920. And fly-blow after the cure?—Yes.

921. (*Dr. Tunnicliffe.*) You say that this refrigerating was not a success commercially—I say that three or four people have tried the bringing over of fresh pork and curing it here, and they have dropped it; I do not know the reason why they dropped it, but if it had been a success from a commercial standpoint they would not have stopped.

922. But the finished product would have had to compete with this boraxed bacon?—The cured product?

923. The finished product as brought over by the refrigerating method when it arrived here would have to compete in the market with the boraxed bacon?—I think the inclination was to bring it over here and sell it as English; that is what I think, because the class of men who were in it I think brought these hogs and hams over from America to cure them on the English system, and my idea was that they intended to sell that as English bacon and English hams. I think that that was the idea, you see.

924. You have mentioned 1 per cent. of borax as the proportion used in packing; I suppose that is 1 per cent. of the weight of the carcase?—Yes, one pound of borax to the cwt. of ham.

925. Can you tell me what is the percentage in salt packing?—I could not tell you that; it varies.

926. Is it larger or smaller?—Much larger.

927. Very much larger?—Yes, I should think they use 5 to 10 per cent., perhaps more than that; quite 5 per cent., anyhow.

928. A good deal of that salt I suppose runs to brine?—Yes, the proportion of salt would vary according to the demand the bacon was expected to meet. If they want it mild they put less, and if they wanted bacon for Ireland they would put more; say 5 to 10, or perhaps 20 per cent., and more than that of the salt.

929. Does the borax become liquid, or does it remain dry?—It remains dry.

930. Then would the tendency of salt to get into the substance of the meat be increased by the fact that it becomes brine?—I do not exactly follow you.

931. You have said that the tendency of the salt is to run to brine?—Yes.

932. That would get into the meat easier than borax, which remains dry?—Yes.

933. Is that your opinion?—Yes, that is it.

Mr. S. G. Sinclair.

17 Nov. 1899.

Mr. S. Gibson Sinclair, called; and Examined.

934. (*Chairman.*) I think you represent the same interest as Mr. Gregson?—Yes; I am a delegate from the same Association.

935. Do you corroborate his evidence?—I corroborate generally his evidence. The only thing is that Mr. Gregson was asked how long meat packed in borax would keep, and he stated that he thought it would only keep a month.

(*Mr. Gregson.*) Excuse me, a month to be fresh, and I thought it would deteriorate a little after that.

(*Witness.*) If the meat were cured pretty hardly—that is, very thoroughly cured and very dry before it was packed—I think it would keep considerably longer, but the very mild meat that is wanted certainly would not, and it would be advisable that it should be used within a month of arriving here. But it is quite possible to cure the meat and pack with the borax, so that it will keep for considerably longer.

936. (*Chairman.*) Is there any point upon which Mr. Gregson has not touched on which you would like to make a statement?—I do not know that there is, except I would like to impress very much upon you that I think that if the borax packing, which, of course, is quite a distinct thing from the curing, were done away with it would destroy the Canadian business. I may say that the Canadian bacon absolutely and entirely comes forward packed in borax. Though there is altogether 25 per cent. of both Canadian and States meat that comes forward packed in salt, it is the most exceptional thing to ever hear of any salt-packed meat coming from Canada. Canadian meat is nearly all put up in the same shape as the Danish bacon, and is very mild, and is intended to compete against the Danish bacon. It is very much in the same style as our Wiltshire bacon. If borax packing were done away with it would simply destroy the entire Canadian trade. I think it would be impossible to bring the Canadian bacon forward in the shape that it is now put up, unless borax packing were permitted. Then there is another thing. You asked about bringing hog carcases forward in refrigerators. I think I can give you a little information as regards that, but not exactly as to bringing it forward in refrigerators. In old times, about twenty years ago, or more, in America, in the western parts, where there were not packing houses, and where the hogs could not come along alive and be killed and cured at once, they used to kill the hogs upon the farms and freeze them, and send them down in a frozen condition to New York and Boston. In those days we had a packing house at New York, and we used to pack a good deal of this meat in the winter time, but that meat was always much inferior to the meat that was killed and cured fresh. Apparently the process of refrigerating or being frozen fastened up, I suppose, the juices, and the meat had to be thawed to a proper temperature before it could be cured. The effect of that seemed to be that you turned out a much inferior class of meat, and it had to be sold at considerably less money. Also when it came forward here to this side, if it was used up promptly, and at once it was all right, perfectly sound and sweet, though not as nice flavoured or nice coloured in any way as the fresh killed meat would be; but if any one who was not accustomed to using this meat kept it long before drying it out, or after, it went bad much more rapidly than the ordinary cured meat. That is a trade that died out, I should think, twenty years ago. You asked that question, and I thought that our experience in New York might give you a little light on what possibly might be the effect of carcases coming forward in refrigerators, and then being cured here.

937. That applies to frozen meat?—Yes.

938. There is a difference between the frozen meat trade and the cold chamber meat, is there not. They do not lower the temperature to the freezing point now do they?—I do not know enough about it; I thought they had to do.

939. Your firm are general provision merchants, are they not?—Yes, our firm are agents for at least one packing house in the States, and one in Canada, and I am also interested in another one in the States, and one over in Ireland, so I know a good deal about the packing part of the business, though practically I have never had charge of a packing-house.

940. Coming now to the other products which you import, do you deal in butter?—Very slightly; I really can give you no information about butter that would be of any value at all.

941. Fish?—No. Cheese is the only other product that we really deal largely in besides the hog product.

942. I hope you do not think me too inquisitive?—No; I shall be only to glad to help you. I am only sorry that I cannot give you more information.

943. (*Dr. Tunnicliffe.*) You said if you cured bacon and put on borax it would keep very much longer than a month?—If bacon were cured very thoroughly. Of course the question of mild curing is more or less a question of the time that is given to it in the salt.

944. Do you mean by curing "very thoroughly," more salt?—A longer time in the salt.

(*Mr. Gregson.*) I wish to confirm what Mr. Sinclair said. When I said that meat will keep a month in borax, as Mr. Sinclair says, if you cure the meat by making it hard it will keep very much longer; but that is not the idea of borax packing. You see we want meat, cured mildly, and packed in borax, and then I think that Mr. Sinclair confirms it, that if will keep about a month. It will keep three or four if it is cured hard; but that does away with the idea of borax packing.

(*Professor Thorpe.*) Have you any idea whether any boracic acid or borax is left in the carcase? Do you know whether it is or is not?

(*The Witness.*) Do you mean if it is washed off here?

945. Yes?—I should think there would be a mere trace. Of course borax being an antiseptic, closes up the pores, and probably there is a mere trace of borax left. I think it is not possible that it could be absolutely all washed off; but I should think practically it is nearly so.

946. If boracic acid was found in the interior of the meat, how do you imagine it got there?—I really could not tell you.

947. Have any complaints been made to you, or have you heard of any complaints as to the effect of eating ham or bacon which has been cured?—No, I have never heard of that, and I have eaten a great deal, and it has never done me any harm yet.

Mr. L. K. Boseley.

Mr. Leonard Kidgell Boseley, called; and Examined.

948. (*Chairman.*) You are analyst to Messrs. Keiller and Son, Limited?—I am.

949. What are they?—They are manufacturers of jam, marmalade, all sorts of confectionery, candied peel, and table jellies. I think that is the whole.

950. May I ask if you are here to give evidence chiefly as to the products of that firm, or on the general question of the use of preservatives?—I intended to give evidence particularly with regard to the amount of colouring matters which that firm are in the habit of using in all kinds of confectionery; and I have also several details as to the amount of colouring matters and preservatives in other kinds of food, which I have gathered from my own practical experience as an analyst.

951. I see you put dairy products first; namely, milk, cream, butter, and condensed milk?—Yes, that is so.

952. What are they most frequently treated with?—Borax, boracic acid, formalin (which is a 40 per cent. solution of formaldehyde), very occasionally with salicylic acid, and also nitrates and sulphites.

953. In what proportion have you found them?—The proportions of borax added to milk by the average dairyman, vary from one part in 1,000, up to one part in 10,000. Those are the outside limits, and I have never found any cases outside those two figures.

954. Would one part of boracic acid in 10,000 have any appreciable effect as a preservative?—I should think it is extremely doubtful. I should say that the quantity was almost too small; but, nevertheless, I have found milks with that quantity. I have known cases in which dairymen have added that quantity under the impression that it would produce some preservative effect.

955. But higher proportions are more frequent?—Yes, they are more frequent.

Mr. L. K. Boseley.

17 Nov. 1899.

956. Are they almost universal, in London, for instance?—They are not universal. I should say that about 50 per cent. of the dairymen in London use a preservative of some sort. I would not like to say that it would be 50 per cent. boracic acid; there might be 25 per cent. boracic acid, and 25 per cent. formalin.

957. Before we leave the dairy products, I should like to ask you whether you have found much trace of preservatives in butter?—Butter, I should say, is more heavily preserved on the average than milk. I believe that I would be justified in saying that from 50 to 60 per cent. of the butter samples sold in London would be preserved. I know that all the French produce which comes over here is systematically preserved with borax and boracic acid.

958. Do you find the borax in the substance of the butter?—All butter contains a certain proportion of water—a small proportion which cannot be eliminated—and it is in that water really that the boracic acid is in solution.

959. Do you know how it is mixed with the butter?—Yes, it is put in during the churning process.

960. During the churning process?—I mean to say that after the butter is manufactured it is put in, and then worked again. After the butter is formed it has to be mixed in again, sometimes in the worker, I believe.

961. Are you speaking now of French butter?—Yes.

962. That is almost exclusively factory butter, is it not?—I believe so.

963. Then it would not be in the churn that the preservative was put in; it would be in the handling afterwards, would it not? However, I do not want to ask you anything that you have not actual knowledge about?—I cannot say. I have only made butters myself from the point of view of testing the effect which these preservatives would have; and I know that I worked them in in that way myself under the impression that that was the way they were usually worked in, but I have no further information on the subject than that.

964. What are the other substances which you have examined?—I next wish to group together such substances as are acid in reaction. Under that heading I would class marmalade, jams, wines, beer, lemon squash, lime juice, and fresh fruit.

965. What class of wines have you examined?—I am unable to say that I have examined any wines myself for preservatives, but I have been working in a laboratory in which such examinations have taken place, and I have the amounts which the analyst who did the analyses found in those particular samples, but I have no personal experience beyond that.

966. Have you any personal experience of beer?—I have no other personal experience of beer beyond in the same way as I have of wines.

967. Of preserves, I suppose you have?—Yes, I have a large experience of preserves.

968. Perhaps you would tell us the result of your experience with them?—My experience with preserves is that certain makers systematically use preservatives in every jam they send out. I should say that the average proportion of English jam manufacturers using preservatives would be 50 per cent. The usual preserve employed is salicylic acid, that is because of the peculiar form of—well, decomposition which occurs in jam, which is due to fermentation; and salicylic acid is practically the only preservative, with the exception of benzoic acid, which is a good thing to stop fermentation, and therefore that is pretty nearly universally employed when a preservative is used at all. It is used in the proportion of about half an ounce of salicylic acid to 1 cwt. of jam, which, when calculated out, comes to one part in 3,500. I believe there is at present a firm in London who are trying to get benzoate of soda taken up as a preservative for jams, because it is a good thing as an anti-fermentative, but it is not being used, at any rate at present, in any great quantity.

969. Is there any preservative added to the fruit before it is preserved?—By the jam makers, do you mean?

970. Yes?—No, not in my experience; I have never known of it. I have known of cases in which fresh raspberries exposed for sale upon a stall have been sprayed with formaldehyde, but I have no details; I have never heard of a jam manufacturing firm in any way treating their fresh fruit with a preservative before cooking it.

971. (*Professor Thorpe.*) Would you kindly tell the Committee what has been your previous experience and training—you spoke of being in a laboratory where you had generally to deal with these kinds of things?—Yes; I was trained by Mr. Otto Hehner, the late president of the Society of Public Analysts, and I had some experience with many other things besides jams and marmalade in his laboratory. After that I was second chemist to the Aylesbury Dairy Company for four years, and that is where I got any knowledge I have as regards butter, milk, cream, and so on.

972. How long have you been in the employ of Messrs. Keiller and Son?—About two years and a-half.

973. You said, I think, that about half of the butters which were sold in London contain preservatives?—I meant by that to say that half the butters which had come into my hands in any way since I have been an analyst were preserved. I should say 50 per cent. of the London butters were preserved.

974. Do you mean by that both imported butters and those which were made in the neighbourhood of London?—Yes, that is including every kind of butter.

975. Is it your experience that all the butters which are made in the vicinity of London, for example in Wiltshire, would contain preservatives?—I should say that it would depend where they were to be supplied to. In regard to the butters we used to have at the Aylesbury Dairy Company sent up and specially made for us in Wiltshire, the makers would not be allowed to use a preservative of any description; but it does not follow from that that if they were supplying any other buyers they would not use it; in fact, I believe in some cases they would be particularly requested to use it if the people who were buying wished the butter to keep for a long period of time.

976. (*Chairman.*) I must remind you that what we want is your own knowledge, and not hearsay. Professor Thorpe asked you if it was within your own knowledge that 50 per cent. of the butter used in London was treated with a preservative?—To that I should simply reply that, taking the butters that I have analysed myself which are supplied to London, it is my experience that 50 per cent. are preserved in some way.

977. Then that knowledge does not extend to the Wiltshire butter?—No.

978. Except what came to the Aylesbury Dairy Company?—Except what came to that company.

979. And that was not treated?—That was not preserved.

980. (*Professor Thorpe.*) Was it part of your business as chemist to the Aylesbury Dairy Company to verify the non-existence of boracic acid and other preservatives?—It was.

981. May I ask whether the Aylesbury Dairy Company has subsequently added any preservative?—They did not use any preservatives in any form whatever in any substance which they sent out, with one exception, and that was stopped, I think, three years ago—that was the cream in jugs.

982. Do they make clotted cream?—Yes, they do make clotted cream.

983. Do they put preservatives in that?—No.

984. Is it your experience that preservatives are not required for clotted cream?—I should say that preservatives are required for clotted cream if you wish it to keep for longer than two days in summer.

985. Are you able to say from your own knowledge in what direction the use of, or the preference for, preservatives is tending? I mean, do you find, for example, that some preservatives are coming into more general use than others?—Do you mean with regard to butter alone, or with regard to what?

986. Generally. I will put it in another way: Is boracic acid becoming more generally used as a preservative than other forms?—I should say it was, with the exception of jams and preserves, or anything of that kind. It would not be coming into more general use in that case, because it is not nearly so good an anti-fermentative as salicylic acid.

987. I gather that in those cases, and in the case of fruits, salicylic acid would be preferred?—Salicylic acid is the preservative of the jam-maker; practically no other is used.

988. In solutions or extracts from fruit salicylic acid would be used?—Just so.

989. Confining ourselves for the moment to milk, is the use of formalin in milk extending, or are the milk dealers finding that boracic acid is alone sufficient for

Mr. L. K. Boseley.

17 Nov. 1899.

their purpose?—I can speak as regards that point from my experience up to 2½ years ago, but I can give you no information that is more up to date than that. I should say that up to that time the proportion was about half and half—that half the milk dealers who used preservatives used to employ borax and that half used formalin.

990. Have you had any experience of the use of formalin as an antiseptic? I mean to say, have you had occasion to witness the behaviour of formalin applied antiseptically as in milk?—Yes, I have preserved several samples of milk with formalin.

991. Have you any information to give to the Committee as to its behaviour?—Yes, I can give the Committee some information upon that point.

992. As to the behaviour of the milk under the influence of formalin?—Yes. The amount of formalin added to the milk varies from one part in 10,000 up to ·05 per cent., or one part in 2,000, which latter amount (one part in 2,000) will keep milk for months in an unchanged condition. That is all the information I think I can give the Committee upon that point.

993. Have you made any estimations ever of the amount of formalin in milk?—No, I cannot say I have.

994. You are not able to say, for example, whether the formalin persists in the milk when once added to it?—It must do so to a great extent, or the milk would not keep.

995. (*Dr. Tunnicliffe.*) To go at once to the subject of formalin, you said that ·05 per cent. kept milk unchanged for months; that was so, was it not?—Yes, that was so.

996. What do you mean by "unchanged"?—By the word "unchanged" I mean to say that the milk would be what is generally known as sweet—that is to say, that very little, if any, lactic acid would be formed in the presence of that amount of formalin.

997. You are not prepared to say that no lactic acid would be formed?—I should not be prepared to say that no lactic acid whatever would be formed, but it must be a small amount, because the milk does not curdle on keeping.

998. What would be the reaction of the milk; would it be strongly acid, or what?—It would undoubtedly give a reaction with litmus paper.

999. It always does, does it not?—It always does. It is amphoteric. It gives both an acid and an alkaline reaction; but, of course, if lactic acid was formed it would give an acid reaction.

1000. Was the reaction changed at all in this milk that you kept for months with ·05 per cent. of formalin?—I cannot say that I tested it.

1001. Did you make any further experiments with this milk—any physiological experiments, for instance? Did you give it to anybody or take it yourself, or anything of that kind?—No, I did not.

1002. Therefore you are unable to say that that milk would be fit for consumption?—I should be unable to say that the milk was fit for consumption. I meant to say that, as far as the taste was concerned, you could not detect any very increased acidity after the use of that amount of formalin.

1003. Have you made any experiments with rancid butter; have you analysed any samples of rancid butter?—Yes, I have had some samples of rancid butter to analyse.

1004. Have they contained preservatives?—Not to my knowledge; I could detect none.

1005. Have you made any experiments yourself with regard to the length of time butter will keep with preservatives?—I should like to say on that point that some experiments have been made, but then I must not talk here except from personal knowledge.

1006. (*Chairman.*) Your personal experience is more valuable to us, of course?—I only know of some experiments that have been made on that point, but I cannot give you any information on that point of my own.

1007. If you witnessed those experiments then you could speak of them from your personal knowledge?—I did not witness them.

1008. (*Dr. Tunnicliffe.*) You have not made an experiment yourself with regard to the length of time that butter will keep with various preservatives in various proportions?—No, I have not.

1009. With regard to the jams, what do you make your jams from at Messrs. Keiller's; is it imported pulp?—No, the whole of the jams, with the exception of apricots, are made from fresh fruit, which is sent up from the country during the fruit season. Apricot jam is made entirely from foreign pulps, mostly Spanish, and, I think, Australian.

1010. (*Chairman.*) Perhaps I may interpose a question in order to make your position clearer. It may appear very ignorant to you, but what do Messrs. Keiller require with an analyst?—Their primary idea, I believe, in starting a laboratory was this: Jams had been made till within two years ago by absolutely rule of thumb methods. There was no scientific knowledge of any description about jams; in fact, I believe until I went to Messrs. Keiller's there was no jam analyses at all. Their idea in starting a laboratory was, if possible, to find out firstly what percentage of sugar (and that, of course, includes inverted sugar formed by the action of the acid of the fruit on the crystallised sugar) which is put in is necessary—what percentage of these total sugars is necessary to keep a jam without either fermenting on the one hand or crystallising on the other.

1011. (*Professor Thorpe.*) But, of course, there are other problems than that still?—Many other problems, but that was one of the first ideas.

1012. (*Dr. Bulstrode.*) I did not quite understand you as to whether you had examined very many specimens of milk, butter, and cream for preservatives, or whether that has only been done in your presence; I did not quite understand your answer to that question as to what your actual experience in reference to milk, butter, and cream has been?—In Mr. Hehner's laboratory I have examined a fair number of samples of milk and butter, but at the Aylesbury Dairy Company there was no necessity to do that, except in the case of outside butters, which we bought. I mean either French or other foreign butters. Their own butter, that is the butter which was manufactured on the premises—and the milk, for that matter—were not often examined for preservatives.

1013. Upon what method of selection of butters was your estimate based of the 50 per cent. of butters in London containing preservatives?—It was based on the samples which are submitted to a Public Analyst's laboratory, taken by inspectors, and brought in by private individuals, and that sort of thing.

1014. Would there be anything in that method of selection which would not tend to the probability of those samples which reached the Public Analyst being in some way treated?—In some way treated?

1015. I mean would it be quite fair to conclude that because in a certain Public Analyst's laboratory 50 per cent. of the butter that is examined contained preservatives, therefore half the butter supplied to London contained preservatives?—That is a point for the Committee to judge; I was merely giving my own practical experience upon the subject.

1016. Were the samples drawn from many sources?—I think that, taking them on the average, they were drawn from a great many sources; they were not all the products of one firm, or of two or three firms, which were sent in.

1017. During how long within your experience did the Aylesbury Dairy Company use no preservative whatever?—From my own practical experience I can state that from six and a half years ago they have used no preservatives in any article except in this potted cream, which, as I say, owing to the action taken by analysts against preservatives was stopped about four years ago.

1018. They have found it possible to carry on their large business without the use of preservatives at all?—I believe that the Aylesbury Dairy Company's opinion is that they are perfectly prepared to run their business without preservatives at all.

1019. In all periods of the year?—During all periods of the year, even in the hottest summer months. I can speak from my own experience on that point. The whole of the milk supply of the Aylesbury Dairy Company during the four summers I was there had no preservative of any kind whatever in it.

1020. What is the longest distance, can you tell us, from which the Aylesbury Dairy Company obtain their supplies?—I should say the extreme west of Wiltshire would be the farthest point, or perhaps Cheshire.

1021. Would the bulk of their supply come from nearer London?—No, it would be nearly all from Wiltshire, Berkshire, and the surrounding counties, and I think Gloucester also; but perhaps that would be further west than Wiltshire. I know there were just a few farms in Gloucestershire.

1022. How long a time would elapse between the milking of the cow and the distribution of the milk as a rule?—I should say ten to twelve hours.

1023. Did the butter come from the same area of supply in the main?—The butter comes partly from Wiltshire, is partly manufactured by themselves on the premises from surplus cream and milk left over from supplying customers, and is partly drawn from French and Danish sources.

1024. (*Chairman.*) You just now specified the term of ten or twelve hours; what does that cover—from the time of milking, to what?—The railway journey up to Paddington, and from there to the Aylesbury Dairy Company, the treatment it received there—I mean in being made up into bulk, and so on, and given out to the different churns—and the time it takes to get to the consumers.

1025. But there is a good deal of difference between its arriving at its destination at the Aylesbury Company's depot and its arriving at the customers; that is, what I want to get at?—That ten hours, I should think, it would be fair to take up to the time it left the dairy, but not when it reached the customers.

1026. Is it pasteurised before leaving the dairy?—No.

1027. None of it?—None of it.

1028. (*Dr. Bulstrode.*) We have got, I think, to the question of butter. Did I understand you to say that some came from Normandy?—I could not say the precise part; I know it was French butter.

1029. What other foreign butters?—Danish occasionally, not often.

1030. Any other foreign butter?—Not that I know of.

1031. Have you tested both those butters, Danish and French, for preservatives?—I have.

1032. What have you found?—In French butters I have found, not always, but very often, boric acid.

1033. How much?—I have not estimated the quantities.

1034. And in Danish?—I cannot give you any particulars with regard to Danish; they were very few samples, and my memory will not carry me as to what I did with them.

1035. Do you think they contained preservatives?—I do not think so.

1036. Then the Aylesbury Dairy Company do receive products which have been preserved artificially?—In years gone by they may have done so; what they are doing in these last two years since I have left, with regard to butter, I cannot say; but I know for a fact that the cream in pots was stopped owing to the preservative.

1037. During your time with the Aylesbury Dairy Company butter supplied to them contained preservatives within your knowledge?—Yes.

1038. Where does the chief cream supply come from?—The cream supply is partly from Wiltshire, and the farmers who supply the milk; but is mostly prepared from milk, on the company's premises.

1039. Is it your opinion that the trade in cream can be carried on without the use of preservatives?—It can be carried on by a large company. They, having an enormous number of customers, would probably succeed in getting about the quantity of cream which they would need, and selling it all in the course of the day, and what they did not sell they would churn into butter; but in the case of a small dairyman, who, perhaps, makes his living on small quantities of cream, I very much doubt whether he would get on without a preservative, I mean, of course, to make the thing pay.

1040. (*Chairman.*) We have had so very much evidence on bacons and hams that, unless you have something special to tell us, I do not think we need trouble you?—Thank you; I think I would rather not give you evidence on that point then.

1041. (*Dr. Bulstrode.*) May I just ask what has been your experience with regard to bacons and hams?—Do you mean in a public analyst's laboratory?

1042. As to the method of the preparation of bacons and hams?—I cannot speak at all from practical experience on that; I can only speak from what I have been told on the subject.

1043. Could you tell us the source of your knowledge, and of your statement that "these bacon and hams are usually soaked in a solution of borax or boracic acid, and then dried"?—As I say, I have no practical knowledge on that subject. That is simply information that I have received from a man who is now in our employ, and who used to be in the employ of a man who treated hams and bacon. He told me that that was the way it was done. It is hearsay.

1044. (*Professor Thorpe.*) Inasmuch as you have been in a public anaylst's laboratory, I should just like to ask you whether it has fallen to your duty at any time to determine the amount of boracic acid which may be present in ham or bacon?—No, it has not.

1045. (*Dr. Bulstrode.*) Has the worker from whom you get this information had very great experience himself in the practice?—I should say not; I do not think he was there for a long period.

1046. (*Professor Thorpe.*) Have you any knowledge of fluorides coming in as antiseptics?—I know that sodium fluoride is being used as an antiseptic; but from experiments which I have made myself with regard to the use of sodium fluoride as an antifermentative in jams, I think it does not work at all well. I believe it is used in other ways, and for preserving other substances than jam; but it does not seem to work well as an antifermentative.

1047. Have you any knowledge, may I ask, speaking generally, of any deleterious action exerted by such preservatives as you have now mentioned?—Any knowledge from my own experience?

1048. Or from your own observation?—I should not like to say that I have.

1049. (*Chairman.*) Now, as to colouring matters; have you directed much attention to them?—A great deal with regard to confectionery and jams. I think I have a complete list of the colouring matters with both their trade and scientific names, which are used in our own firm for colouring all kinds of sweets. I can give you the complete list of these; with the quantities that are used. (*See App. No.* 18.)

1050. But, first, as to your experience with the dairy trade. There is a certain amount of colouring matter used there, is there not?—That is so. In the dairy trade the colouring matter that is practically always used is annatto, which is an extract of a plant, *Bixa orellana*. I had some difficulty in finding out what quantity of this colouring matter was used, because it is usually sold in an aqueous solution for colouring milk, and in a solution of cotton-seed oil for colouring butters. I managed to get to the original extract from the plant, and I find that the average amount of this colouring matter used in milk is about one part in 300,000, that is of the original substance of the solution which is sold to a dairyman, and which, of course, contains a lot of water or cotton-seed oil, as the case may be.

1051. That would be quite insufficient to affect the flavour?—Quite insufficient.

1052. Has the plant got any native flavour?—I do not know. I have no experience of that.

1053. The next group you take consists of condiments?—Yes, that is so.

1054. Among those, what are the chief colouring matters you find. I should like to ask you one question on that?—The information I have obtained on all these sorts of condiments is from a man who has had, I think, six or eight years' experience of their manufacture, and I have no absolutely personal experience on the subject; but I have every reason to believe that his information is correct, and these details I am able to give you are what I have from him. I do not know whether you would choose to accept them or not.

1055. I am in the hands of the Committee; for my own part when an analyst comes into the box I should like to confine myself to questioning him on what he has done himself. Has your informant supplied you with the proportions?—Yes, he has in some cases.

1056. Would you be good enough then to give us the proportions?—The first article in which he gave me the proportions which he prepared, was for the red pickled cabbage for a certain firm whose employ he was in. If the colour of this pickled cabbage was at all off they used to add four ounces of sulphuric acid to a 40-gallon barrel. The sulphuric acid, of course, reddened the colour, and gave it a much brighter appearance. That sulphuric acid, perhaps, could be hardly classed as a colouring material; but at the same time its effect was much of the same kind of thing. With regard to piccalilli, that has 3lbs. of turmeric to a 40-gallon barrel as a colouring matter. I think those are the two chief pickles which I have. I do not think the other matters in the list would interest the Committee, seeing that I cannot speak to them from personal experience.

1057. (*Professor Thorpe.*) Of course, strictly speaking,

Mr. L. K. Boseley.

17 Nov. 1899.

sulphuric acid, as you rightly say, is not exactly a colouring matter; vinegar would, no doubt, brighten the colour of the cabbage, but perhaps not quite to the same extent?—Not quite.

1058. Of course, acetic acid or an organic acid has not quite the same power in reddening the cabbage as a mineral acid would have?—No.

1059. But, of course, there is very little left in of the mineral acid. As regards the other, the addition of turmeric to piccalilli, that may be regarded as a natural product to add just as you add turmeric to curries in the same way?—Just so.

1060. That is scarcely a mis-use of a colouring agent, is it?—No, I should say it was not; it is an ordinary constituent in that case.

1061. (*Chairman.*) Do Messrs. Keiller do anything in preserved vegetables, like peas?—Nothing of that kind at all; bottled fruits are the only things we do in that way.

1062. I suppose they are coloured to a certain extent?—No, the bottled fruits are not coloured, neither are they preserved; they are sterilised.

1063. In jams, I presume, there is a certain amount of colouring matter?—Yes. In reference to jams, I can give you a good deal of information which I have as regards the colouring matters. First of all the colouring matter most often used in jams, in fact, which is practically universally used for all jams of a dark-red colour, is magenta or fuchsine, which is an acetate of rosaniline, or a hydrochlorate of rosaniline. That colouring matter with jam makers who do use colouring matter is practically the universal material. There is another colouring matter, which is called vermilion, and is a lighter red, which is also used by jam manufacturers. I am sorry I cannot give you the absolute composition of that, but I know it is an aniline dye. Then with regard to the amount of these colouring matters which are used in jams, magenta is added usually at about the rate of half a gramme to a hundredweight of jam; that is to say, if you calculate it out, one part in about 100,000. Very seldom indeed the amount of magenta would get as high as one part in 75,000; that would give you a most brilliant-looking jam, and it would be quite an outside quantity. Vermilion is usually added at the rate of about 1 in 80,000 parts. Those are practically the only jam colours that are used largely. It is very seldom indeed that apricot and marmalade and yellow jams are coloured, because the lighter the colour in the case of those fruits the better, the jam would then be bright; but in the case of dark coloured jams, when the fruit happens to be a little bit off colour, it is quite a common thing to find magenta. Then as regards confectionery, if the Committee like I can give them a complete list of the colours which are used in confectionery making, and also some of their scientific equivalents.

1064. If you please?—The first colour that is used is known to the trade as French cream pink—rhodamine.

1065. (*Professor Thorpe.*) Perhaps it would be better if you would kindly hand in that list, or a copy of it, to the Committee?—Yes. Shall I make a copy of it and send it on? I do not think you could perhaps get it from my notes.

1066. If you will kindly do so we shall be obliged. Perhaps you will furnish it to Mr. Huddart. I understand we shall have the scientific equivalents of all these things?—I am sorry to say that I cannot give you the scientific equivalents of the whole of them, but I can give you, I think, more than half. I had exceptional trouble with the manufacturers of these colours; they practically declined to give me any information, but I managed to get hold of more than half of the scientific names; that is all I could do.

1067. (*Chairman.*) It would be interesting if you will make the list up as far as you can?—Yes, I will see that that is sent in. (*See App. No.* 18.) Then, going on a little farther, I have brought up for the inspection of the Committee, if they would like to see them, samples of sweets of several different kinds, labelled with the amount of colouring matters in them. These, I think, would enable the Committee to see at a glance exactly what the depth of colouring matter ordinarily used in sweets is. I can give you the whole of the figures for these particular sweets. I think they are all labelled with the various colouring matters. With regard to lozenges, first of all the colouring matter in an ordinary lozenge varies in amount from one part in 2,300 in the deepest coloured article, up to a very delicate colour, which is made from one part of colour in 30,000 parts of sugar.

1068. (*Professor Thorpe.*) If you would kindly leave that box I should be glad to have an opportunity of going through them. I do not think they are likely to be eaten here?—I will leave the box. I think you will find the labels of the various amounts of colouring matter on the top of each row, if they have not been removed. I may say that those sweets have been prepared under my inspection during the last week, and I can vouch for the amounts of colouring matters that have gone into them, because I put them in personally.

1069. They are commercial examples, I presume?—Those are just as they would go out in the ordinary way. Those sweets are coloured with one or other of the colouring matters in that list I have given you.

1070. (*Chairman.*) Do you think we have exhausted the subject of colouring matters now?—I think I have given you the quantities which are added to the jams and the quantities which are added to the confectionery, and the names of the different colours. I think you have a complete list for both jams and confectionery.

1071. (*Dr. Bulstrode.*) In your proof you say: "The amounts of colouring matters in the other substances quoted above can be given at the meeting of the Committee, also experiments conducted as to the effect of colouring matters on digestion by pepsin and pancreation, and the above synopsis amplified"?—Yes, just so.

1072. Could we have those experiments; were they conducted by yourself?—No. That is a reference to where these experiments can be found.

1073. Could we have the references?—Certainly. You will find them in the "American Chemical Journal." They are experiments conducted by H. A. Weber, "American Chemical Journal," 1896, xviii., pages 1092 to 1096.

1074. Is it your experience that metallic colouring matters are used at the present time?—Metallic colouring matters, as regards our own firm, are not used at all. There is one thing I should like to make a remark about, and that is, these colouring matters which we use at the works, the aniline colouring matters, are prepared by a firm in London, and I know that they are about as free from arsenic and lead as they can possibly be. The employees of the people who make these colours, and send them down to us—in fact, the people who are working in the colour department all day long I should think absorb more colour into their system than anybody else. It seems to produce no effect on them at all; their health is perfectly good in every way.

1075. Further on in your synopsis you mention "sausages, potted meats, cakes, cocoa, and such vegetables as peas and beans"; have you any knowledge yourself of the use of the mineral colouring matters with the peas and beans—such as copper, and so on?—None beyond what I have learnt in Mr. Hehner's laboratory. In some samples which we had there to my personal knowledge there was copper.

1076. Can you tell us the amounts found in peas and beans within your knowledge?—I could do so, but not off-hand; I mean I could send them, if you like, with the confectionery details.

1077. (*Chairman.*) Yes, that would be desirable, I think, if it is not giving you too much trouble?—Not at all. I will make a note of that, and get the figures and send them. I have them in a book.

1078. (*Dr. Bulstrode.*) One more question as to the purity of the annatto used. Can you tell the Committee anything with regard to that?—No, I am sorry to say I cannot.

1079. Annatto is much adulterated, I understand?—I am afraid I cannot give you any details of that; I have never analysed any annatto.

1080. (*Chairman.*) You have told us that a certain amount of preservative is necessary, but we may take it, I presume, that colouring matter is not necessary in preserves?—It is not.

1081. But it improves their appearance?—Yes.

1082. I understood you in the former part of your evidence to refer to preservatives as being necessary?—To preserves?

1083. To jams?—If the Committee would like, I could give them my opinions on that subject.

1084. Yes, if you please?—I have written here a certain statement as to whether preservatives are necessary or not with regard to jams. I think there can be no question whatever that a manufacturer employing the aid of preservatives can turn out the product in far better condition and far more palatable than one who does not

Mr. L. K. Boseley.

17 Nov. 1899.

use them. The following question also arises: Is it preferable to eat an article without preservatives—say in the case of bacon and ham, and so on—and take the chance of any evil effects which may arise from a substance having become slightly decomposed, perhaps, with the formation of ptomaines, etc., or is it preferable to eat one with one part in 3,000 of, say, boracic acid? But with regard to jams, it is a matter of great difficulty to prepare a jam with such scientific accuracy that it shall keep for, say, eight months. You see it is necessary for a jam-maker to make his whole stock during the fruit season, and then that jam must be made in such a way that it will keep for eight months, or perhaps even twelve months, until the next fruit season comes round. It is a matter of exceptional difficulty to do that. I have found out by experiments exactly what percentage of cane sugar, or, rather, beet sugar and invert sugar, is necessary to keep a jam. But even when you have found out that, it is very difficult to get any workman to boil a jam to exactly the pitch you want it. We have found by experiment the percentage of sugar necessary to keep a jam, and if it was possible for a man to work to that, then it might be possible to do without preservatives; but at present they cannot boil within about 2 per cent. of sugar—not with their present methods of working—by the eye, that is. It is really far preferable to boil a jam slack, say till the total sugars in it shall be about 60 per cent., because the flavour will be much better, and for the reason that, being a shorter cooking, you are not apt to drive off the flavour, to volatilise it, with the steam which goes off in cooking. The jam-maker who uses preservatives can afford to boil his jam slack, so he can leave it in the finished article with 6 per cent. more water than a jam-maker who does not use preservatives, because there is no chance of it fermenting. If you put in salicylic acid you may boil your jam slack; it will look better and taste better, and it will keep for eight months without any trouble whatever. On the other hand, a jam-maker who does not use preservatives will have to cook the jam to a much higher percentage of sugar, and then it is very thick and gluey, and it has lost a good deal of its flavour from its extra cooking, and occasionally you get a crystallisation of the sugar on the top from the excessive amount of sugar that is present. Of course, this gives a jam-maker who uses preservatives a tremendous pull over one who does not; he gets about 6 per cent. more profit out of his article, because he has 6 per cent. more water in it, and there is not the slightest doubt, even if he exports his jams to very hot climates, that they never ferment, and he has no trouble with them at all. On those grounds I say that a jam made with preservatives is preferable to one without from the point of view of taste and consistency, and everything else. But at the same time it is possible to make jams without preservatives. If you only boil them stiffly enough they will stand any climate, and they will keep for eight months or probably a year. That is really the whole case in a nutshell.

1085. You are talking now of making jam in large quantities?—Yes.

1086. I suppose you agree that in many a house an old housekeeper can make as good jams without a preservative as with it?—I should like to say one thing upon that point, and that is this: With regard to the old housekeeper kind of jam, they generally cook it about two hours over a fire, and in the case of a jam-maker who actually goes in for the thing in a wholesale way it is cooked by steam pressure in copper pans, sometimes lined with silver, and the total length of time in which the jam is cooked is counted by minutes. If we were to boil it over a fire for a long time we should undoubtedly get a nice tasting article, but the sugar would be partially caramelised, it would be burnt brown, and we should sell nothing at all, because jam sells entirely on appearance with the public. They see it in a shop window, and if it looks nice they buy it, and therefore the aim of the jam-maker is to make the jam with a good colour, and that can only be done by cooking by steam in copper pans.

1087. (*Dr. Bulstrode.*) Could you tell us how the salicylic acid is added to the jam; what is the method of addition and mixing?—Yes. This half-ounce, which I think I said was put into a hundredweight, is simply taken in the form of a powder and put into the pan with the sugar, fruit, and, if it is used, glucose, and mixed up, and then you completely boil it. Salicylic acid is cooked in the jam for the period of cooking.

1088. Would that method of preparation guarantee the thorough mixing of the salicylic acid, in your opinion?—Yes, certainly; because the ebullition is tremendous in the cooking process. The steam pressure is 50lbs. to the square inch, and the ebullition is therefore so great that the thing would be mixed perfectly.

1089. Have you any knowledge of the absolute amount of salicylic acid which has been found by experiment in, we will say, a pound pot of jam?—No, I have not. I have had no outside jam to analyse in order to determine the salicylic acid since I have been to Messrs. Keiller's.

1090. How much should there be in a pound pot of jam?—There is 0.5 of a gramme in a hundredweight, which is 112lbs., so in one pound there would be about 0.005.

1091. (*Professor Thorpe.*) Five milligrammes?—That is it.

1092. (*Dr. Bulstrode.*) You think it ought to be entirely mixed—that is the point I want to get at?—If you take marmalade, I should say so, because I know this from experience: If you estimate the sugar in, say, six different parts of the pot you get within 0.2 per cent. of sugar in every case; it comes out exactly; so I should say that it was perfectly mixed. There is one other point I should like to tell the Committee about if advisable, and that is that jam-makers have another difficulty in that it is not always advisable to make all your jam during the fruit season, especially if you don't use salicylic acid, and have to keep the jam for nine months. In order to get over that difficulty they have devised a process of sterilising fruit; they cook it—that is, boil it with water for a fair amount of time, and then put it down in stone jars and hermetically seal it. Now, one would have thought that it would have been possible to sterilise the fruit in that method so that it would not ferment on keeping; but that is not always so, you cannot always do it. These pulps, as they are called, in the jars ferment on keeping, and the jars burst, and, of course, the jam-maker is subjected to a certain amount of loss. If you put in one part in 3,000 of salicylic acid you are never troubled in that way at all, and you can keep pulp for nine months in beautiful colour, and it will come out just as good as it went in. But on the other hand, you may say: "Could not that be got over by increasing the time of boiling?" or something of that sort. It can be done so, but I am afraid if you cook your fruit any longer than a certain period you will ruin the colour. It really seems almost as if one was forced to use salicylic acir if you want to lay down these pulps and keep them.

1093. (*Dr. Tunnicliffe.*) In spite of salicylic acid, I presume you get occasionally a make of jam go wrong?—I have never known an instance of jam going wrong with salicylic acid.

1094. You never have?—Never, unless it was made in a perfectly ridiculous manner.

1095. Have you ever known a pulp go wrong with salicylic acid?—Never.

1096. (*Professor Thorpe.*) Had you experience at the Aylesbury Dairy Company in the use of colouring matters in milk and butter?—Yes.

1097. The only colouring matter there used is annatto, is it not?—Yes.

1098. There are other butter and milk colours to your knowledge, are there not?—To my knowledge, I remember a case once in which an aniline dye was used.

1099. In what case; I mean for what article?—An aniline dye was used in a milk. I can tell you another thing. I have the information from Mr. Richmond, the analyst of the Aylesbury Dairy Company, that aniline dyes are getting more common in milk; but that is not my own experience.

1100. When you say aniline dyes, what do you mean?—I cannot tell you what aniline dye it was; it might have been what is practically known as methyl orange, but I do not know.

1101. In all cases within your knowledge do I gather that butter is coloured with annatto dissolved in cotton seed oil?—That is so.

1102. No other vegetable oils used?—Not that I have ever heard of.

1103. As regards butter colours, I suppose you know that other colours than annatto are used in butter?—I do not know.

1104. You do not know?—No; we never used any other at the Aylesbury Dairy Company; it was always annatto.

1105. It has not come within your personal knowledge as a butter analyst with Mr. Hehner, for example, that other colouring matters have been used?—No, not that I remember.

Mr. L. K. Boseley.

17 Nov. 1899.

1106. What compounds of iron do you know are introduced in sauces and condiments?—That is a matter in which it is a case of being told; it is not personal experience.

1107. Do you know what compounds of iron are used; can you tell me what you were told?—I do not seem to have got it entered here in my notes; it is simply put down as "iron salts." I am afraid I cannot tell you.

1108. Do you know what sauces you are particularly referring to?—No. The information came, I believe, from the same informant who told me about the pickled cabbage and the sulphuric acid. I cannot tell you beyond that.

1109. Have you any more definite information in respect to the use of aniline dyes in sauces?—I have no more definite information.

1110. You do not know the names of the aniline dyes?—No. I cannot say that I do.

1111. That information is not among your notes?—It is not among my notes.

1112. In your proof of evidence you speak of mustard being occasionally coloured with Martius' yellow?—That is so.

1113. Has that come within your own personal knowledge?—Yes. That was a case which Mr. Richmond had when he was at Mr. Hehner's with me.

1114. Is it at all common, do you think?—It is not at all common; it was an exceptional case.

1115. Of course, you know the chemical composition of Martius' yellow?—Yes, I do. I know it is a poison.

1116. You have never heard of Martius' yellow being introduced into butter?—Never within my knowledge. I cannot say that I have.

1117. In your proof you speak of sugar occasionally being treated with aniline dyes; of course, that is the Demerara you are speaking of?—Just so; it is the imitation Demerara made up from beet sugar.

1118. Now, you were asked a question as to the presence of metallic colouring matters, and you said you had some experience of their being present in peas, which had come under your notice in connection, I suppose, with the working of the Food and Drugs Act when you were with Mr. Hehner?—That is so.

1119. Have you made any critical examination of this question?—The colouring matter is, of course, mainly copper in the case of peas?—Yes.

1120. Is that added copper colour present throughout the mass of the pea, or is it in the outer coating of the pea, or where is it?—I have not made any experiment as to that.

1121. You have no knowledge?—I can try and get you the information when I get the other, if you like.

1122. You yourself have no information?—No. I have not in my own experience.

1123. When you had those peas to analyse, you took the pea as a whole, I suppose?—That was so, as a whole.

1124. Is the colouring matter in such a form that it could be assimilated, do you think?—Do you mean is the copper colouring matter in such a form?

1125. I am speaking, of course, of the copper colouring matter, the extraneous colouring matter?—I do not know what form it is added in, I am afraid.

1126. You do not know how the peas are coloured?—No, I do not know whether it was added as a sulphate or any other salt of copper of that kind.

1127. I did not ask you how it was added, but how it was present?—I see; I do not know.

1128. (*Chairman.*) There are other methods of getting bright-coloured green peas, are there not?—I believe there is a method; they add some zinc compounds to them, I fancy.

1129. Does not every cook know that boiling peas with a little soda turns them green?—I believe so, but I am talking of preparing peas commercially.

1130. (*Professor Thorpe.*) Are you speaking from your own knowledge when you say that oxide of iron is to be found in cocoa?—Yes.

1131. Could you give the Committee any information on that point?—Yes. Colour enters into the manufacture of cocoas, as I dare say you know. The particular samples that I refer to in my proof came before me in this way: A firm wrote to us and said, "Would you kindly match these samples of cocoa?" These samples of cocoa were sent to me; they were mixtures adulterated with starch, and the firm wanted to know what their composition was, so that if necessary they could be imitated. On testing the ash I found an excessive amount of iron oxide.

1132. Did you estimate the amount?—The ash, I believe, of our ordinary cocoa runs about 2 to 3 per cent., or something like that, and this particular ash went up, I think, to 6½ per cent. I know, at all events, that the reaction I got for iron was far greater than it usually is in a normal cocoa unadulterated; but I cannot give you the precise percentage of iron oxide which would have been there.

1133. Did you seek to discover what particular form of oxide of iron was there; I mean what it would be?—I think Fe_2O_3.

1134. I know that, of course, but what character of Fe_2O_3?—I cannot tell you that.

1135. Of course, it was a brown colour you were getting?—Yes, a brown colour. Of course, the starch when added in quantities like 30 per cent. of the cocoa dilutes the colour, so that it is most miserable looking stuff unless there is a brown oxide of some kind put into it to colour it.

1136. You do not know whether it was the deep red oxide of iron which is used as a paint?—Rouge, do you mean?

1137. Yes, or powdered hematite?—It was distinctly browner than rouge. It was not of such a red colour as rouge, because cocoa is of a brown colour. This was not of the same colour as rouge; it was distinctly darker than that.

1138. Would it be simply an ochre that was added?—It might be an ochre, I should not like to say for certain; but I should think so.

1139. With regard to the delicate lavender that you speak of in your proof as being occasionally used as a colour, would you give us the composition of that in the notes you propose to send us? What is that delicate lavender? Perhaps you have it there?—It is Hofman's violet. It is a hydro-chlorate of triethyl-rosaniline, really it is a mixture of that. I rather think it has been let down with milk sugar. I think it was too strong a colour. Hofman's violet is really what we call heliotrope for confectionery colouring, and the lavender I think is a mixture of that and milk sugar.

1140. That is the "delicacy"?—Yes, just so; that is the "delicacy."

1141. You use, I understand, magenta?—Yes.

1142. Considerably, where you have to have a deep ruddy coloured jam?—No, not in jams, but in confectionery. We do not use it ourselves; personally we use no colouring matters at all in jams.

1143. (*Chairman.*) I did not understand you to say that at first?—That is so. We use neither preservatives nor colouring matters in jams. I do not say that we should not use preservatives if it was legal to do so, because we should like to immensely; but in our jam and the marmalade that we have made up to the present time we use neither colouring matter nor preservatives. I did not like to make a statement to that effect, because it is a sort of advertisement; but as a fact it is so.

1144. It is interesting as turning on the question of the necessity of preservatives?—Yes. I have said so much because we feel we are hardly used on the subject. Other jam makers who do use these things have a big pull, and we should very much like to use them; but the firm has a reputation for marmalade, and they have left it alone.

1145. (*Professor Thorpe.*) I understand you to say that you procured the magenta from a certain place?—Yes.

1146. And that you had observed that the workpeople employed in the manufacture of it had their hands and skins perfectly saturated with it?—Yes.

1147. What were you referring to?—To the workpeople who blend the colours—the people we buy the thing from, not in our own works.

1148. You use magenta I understand in your works?—Yes.

1149. For what purposes—confectionery?—For confectionery.

1150. That is English-made magenta, may I ask?—I do not think so; I think it is German, but I would not be sure.

1151. Do you happen to know whether it is made under Medlock's expired patent, or what it is made from?—I cannot tell you, except that I know it is an acetate of

Mr. L. K. Boseley.

17 Nov. 1899.

rosaniline or a hydro-chlorate; sometimes it is the one, sometimes it is the other. That is all I know about it.

1152. I am asking particularly, because you made some reference to its freedom from arsenic?—To the confectionery colours generally having freedom from arsenic.

1153. You specially instanced magenta?—Did I?

1164. Yes, I noted that. The point I want to get from you, if I can, is what is the origin of this magenta?—All I can tell you about it is that we buy these colours from a certain trader in London—Harker, Stagg, and Morgan. Practically, most of our confectionery colours, the magenta included, are bought from this firm. I have it from their chemist, a man I know perfectly well, that the people who mix these colours, and work with the colouring matters inhale a great deal of it in the form of dust and so on into their lungs, and their health never seems to be impaired. I mean people who have worked there for six years. I rather believe that he guarantees several of these colours as being absolutely harmless.

1155. Does he guarantee the magenta as being free from arsenic?—No, in that case he does not.

1156. Do you test this magenta for arsenic?—No, I have not tested it up to the present.

1157. Do you not find it necessary to do so, knowing that arsenic is occasionally used, or has been used, in the manufacture of magenta?—I think the firm have up to the present time simply taken the guarantee. These colours, I may say, are sold by Messrs. Harker, Stagg, and Morgan as being absolutely harmless. In every case we have that put down.

1158. You do not yourself verify that statement?—No, I have not verified that statement.

1159. With respect to your experience in connection with Messrs. Keillers, do you find that jams or marmalade show any greater proneness to go wrong from beetroot sugar than from cane sugar?—I cannot answer that, except in this way—that we never use any cane sugar by any chance; therefore I have not had a chance of comparing the two. Personally, I very much doubt whether there would be the slightest difference.

1160. The character of the beetroot sugar that you use, I suppose, is not the highest refined form?—Absolutely the highest refined beet sugar, with 99·85 per cent. of absolute sugar in it is what we use for the jam and marmalade.

1161. There is just one other question which I wish to ask which bears perhaps upon the point, although it does so indirectly; I ask it as much as anything for my own information, but no doubt you will be able to tell me. It is commonly stated—I do not know on what authority—that if you add to moderately acid fruit which has been cooked the sugar after it has been cooked, the resultant sweetening effect is greater than when you add the sugar during the process of cooking?—I should say it was the other way about, and for this reason; that it is well known that invert sugar has a higher sweetening power than cane sugar, and if the sugar is added with the fruit and boiled up with that, the acid in the fruit would have the longer time to act, and therefore there would be more invert sugar formed; and naturally the resulting compound would taste slightly sweeter, I should think.

1162. Of course, when boiling with an acid the sucrose is split up into two forms?—Yes, laevulose and dextrose.

1163. Which collectively are less sweet than the sucrose?—They collectively are more sweet.

1164. They collectively are less sweet?—At all events, there would be more invert sugar formed if the sugar was boiled up with the fruit than there would if it was done in the way you said, would there not?

1165. I asked this question because it had reference to your method of manufacture as compared with the ordinary household method. There is no question whatever that in the ordinary household method of making jam, the process of making jam in that form converts the sucrose to its utmost extent, whereas when you boil it for only a few minutes the probability is you still leave a considerable quantity of sucrose unconverted?—The proportion of invert to uninverted sugar in our marmalade would be as $\frac{1}{3}$ to $\frac{2}{3}$. It has not been run up higher because we find as a general rule that a jam with a tremendous amount of invert sugar is much more liable to fermentation.

1166. Perhaps you would not object to come again if we have anything further to ask you?—Certainly not; if I can be of any use I shall be only too pleased.

FIFTH DAY.

Monday, 20th November, 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

H. TIMBRELL BULSTRODE, Esq., M.D. | F. W. TUNNICLIFFE, Esq., M.D.

CHARLES J. HUDDART, Esq., *Secretary*.

Mr. JOHN WALTON COPEMAN, called; and Examined.

Mr. J. W. Copeman.

20 Nov. 1899.

1167. (*Chairman.*) You are a partner in Petty, Wood, and Co., I think?—I am not a partner by deed, but I am general manager of Petty, Wood, and Co. I have an interest in the business. I have been in the preserved food department for twelve years, and I have the general management of the selling of the firm.

1168. So you can tell us something about the preservatives used in the grocery trade?—Yes. The principal part of my evidence you will see by the synopsis I have sent in is more directed to the preserved vegetables than to any other part, but I should be very glad to answer any question with regard to other things so far as my knowledge goes.

1169. Can you tell us generally what preservatives are mostly used?—Yes. We generally use salt, saltpetre, sugar, oil, vinegar, and glucose. Those are the principal ingredients used in preservatives in the regular grocery trade, outside the provision trade, which I presume is not exactly in my department to-day.

1170. Those are, no doubt, preservatives within the more limited sense of antiseptics?—Just so.

1171. Have you any experience of modern antiseptics?—I have not—not in the manufacturing.

1172. Then perhaps you would tell us about the colouring matters used?—With regard to colouring matters sulphur is used largely in bleaching dried fruits, such as Valencia raisins, Californian dried apricots, and various articles of commerce in the dried fruit trade, such as Carlsbad plums, and so on.

1173. That sulphur is consumed by whoever eats the fruit?—It is consumed by them, but not in any large quantity. It is sometimes to be observed in the taste. I have distinguished it in apricots when I have eaten them; I have observed the taste of it then. I do not think there would be any injurious effect at all. I do not know that there is any harm in having a little sulphur, although sometimes it is objectionable in flavour. It is used to make the goods appear of a good colour. Sometimes the goods would be of a dark colour if sulphur were not used to bleach them. In regard to Valencia raisins, some of the very finest fruits that come to this market are bleached by the use of sulphur.

Mr. J. W. Copeman.

20 Nov. 1899.

1174. And the public, I suppose, have learned to attach importance to the appearance?—They attach a great deal of importance to the appearance. They also use sulphur to give a bloom to the fruits. Take, for instance, the Carlsbad plums that are sent over here, one of the nicest fruits we get, there is an artificial bloom given to them by the use of sulphur which makes them pleasing to the eye, and there is no harm in it whatever. Sulphur is also used in the preservation of champignons, which you have served in the small button mushroom—the French article of commerce. There it is used to advantage in conjunction with lemon juice. The ordinary fresh preserved fresh champignon when it first comes to this country, even when the lemon juice and the sulphur are used, looks sometimes a bit brown, and the action of the lemon juice and the sulphur causes it to have an even, nice, light yellow colour, which is pleasing to the eye. Sometimes it removes a bruise or something of that kind in the champignons.

1175. Can you tell the Committee what percentage of sulphur is used in a bottle of champignons?—A very small percentage indeed, I should think.

1176. But you cannot give the exact proportion?—I could not give you the exact quantity. Then cochineal is used for red colouring in many articles of commerce such as jams, jellies, and so on. Of course, it is used very much by cooks in the ordinary way in the preparation of jellies; and amongst manufacturers it is used pretty freely in imparting a nice red colour to the goods. I believe it is perfectly non-injurious.

1177. Is not sulphuric acid a more commonly used colouring matter in jams and preserved fruit?—I have never heard of it.

1178. Are there any other colouring matters in common use?—I believe carmine is used in France in the colouring of glacé and crystallised cherries. Copper is used also in slight quantities for fixing the colour of greengages in France; I do not think it is used much in England, but it is in France, and it may be in some other countries. Turmeric is used in colouring piccalilli and that sort of thing; saffron in some things, and, of course, Spanish annatto. They are perfectly non-injurious, I believe. Annatto is used in colouring butter and cheese—more in the provision trade, perhaps, than in the grocery trade. Colouring matters are used in anchovy sauce. If colouring matters were not used anchovy sauce would not be at all pleasing to the eye, and would not be merchantable. Then I have had some considerable experience of the business in preserved cherries, which are sent over here in bottles. Although the cherries may be of a very fine quality, if they appear light in colour in the bottles I have known over and over again—in fact, it is very general in the trade—that many grocers cannot sell them, and they return them to the wholesale houses; therefore the packers have to use cochineal to make them appear of a bright red colour.

1179. If the public were generally informed that the bright colour was due to artificial matter added, would they be content to take the fruit as it was in its natural state?—They would not, I think.

1180. Even if they knew what was the nature of the colouring matters?—They would not trouble about it at all. They like to have things presented in a form which pleases them best, and they prefer to have it so.

1181. Most of these goods which you have mentioned are consumed in small quantities, but I suppose we may take it that preserved vegetables are consumed in larger quantities?—I would hardly go so far as that. The various goods that I have enumerated are used pretty largely. They are in daily consumption, and I should say some of them in larger quantities than preserved vegetables, but still they are in pretty fair daily use, I may say.

1182. Take green peas for example. A man would probably eat a greater weight of green peas than he would of strawberry jam?—A man would. I do not think a lady would.

1183. I suppose the peas are coloured also?—I may say that preserved vegetables—I had better say more than peas, because all green preserved vegetables are treated in that way—have their colour fixed by sulphate of copper. That includes peas, beans, spinach, and mixed vegetables as well that are sold.

1184. And do you say that these cannot be sold without it?—In fact, they are entirely unsaleable in this country without they are green, and in some other countries, too.

1185. Have you tried any without colouring?—Yes. I have over and over again.

1186. With success?—You cannot sell them in this country. I have seen them served in a West End club, and I have seen them sent back over and over again. They have tried them for two or three weeks, both peas and beans, and the members would not eat them.

1187. That is without colouring?—Yes.

1188. Have you tried any non-metallic colouring matter?—Yes, we tried some few years ago chlorophyll, a vegetable colouring matter, made, I believe, from spinach juice, but it was an absolute failure, and the peas would not keep. In fact, after the peas had been preserved about six months, when you opened a tin the smell was so offensive that no one would care to eat them. If I may so describe it, you may probably have had the smell of cabbage water, which is very offensive, and this perhaps is a bit worse.

1189. Does the sulphate of copper act as a preservative as well as a colouring?—That has been a matter of doubt with some authorities, but in my opinion it has a slight preservative character as well as fixing the colour.

1190. Can you tell us in what proportion sulphate of copper is used?—I have handed you a paper which came in 1896 from the French Chamber of Commerce to the London Chamber of Commerce on our application at that time, in which you will find the analysis made by M. Riche, one of the greatest chemists in Paris, at the instigation of the French Chamber of Commerce, and the Government itself. There you have set forward the analyses of the different packs—Italian, English, French. They are all tabulated there, and he gives you the proportion. The general proportion, in my opinion, as used amongst makers in France, and in this country, too, is about equivalent to from two grains of sulphate of copper per lb. of peas to 2·7 or 2·8. I believe that is the regular proportion that is used by manufacturers. I may say this, that according to the condition of the peas sometimes they are obliged to use a little more than they are at other times. For this reason, in a very droughty season perhaps it is necessary to use a little more sulphate of copper than they would when the peas are grown at a time when they are more perfect in quality.

1191. Do I understand rightly that in some of the United States, in Switzerland, and in Italy, a maximum proportion is prescribed by the legislature?—Yes, and I have given the quantity—it is one part in 10,000 in parts of Switzerland and Italy. The quantity in America I have not with me, but in Pennsylvania and New York they have taken it into consideration and have allowed the peas to be sold there so long as a label is affixed to them stating that artificial colouring is used.

1192. In the other cases is there a statutory maximum of one in 10,000?—In parts of Switzerland and Italy it is one part in 10,000, but that is not sulphate of copper, I may point out; that is, one part of metallic copper in 10,000.

1193. What is the law in France?—In France the present system is allowed without any restriction. I hand in now the original document which the London Chamber of Commerce received from the Chamber of Commerce in Paris. There they give you the full particulars. I may say this, that the Hygienic Board there which settled this question at the instigation of the Government some years ago did away with the old prohibition system in France, and allowed the present system to come into force. I may say that some of the most eminent chemists and scientific men in Paris sat on that Board, including Pasteur. You will see from this document that no trouble has ever occurred in France since.

[*The witness handed in an official copy of M. Grimaux's Report, "Sur le reverdissage des conserves alimentaires au moyen des sels de cuivre," and a certified stamped copy of an Order of the Prefect of La Gironde. See App. No.* 21.]

1194. I understand that Committee recommended the removal of the restrictions, and that there have been no restrictions in France since?—Yes. I have handed in the stamped copy of the Order of the Prefect of La Gironde in order to show how the Government edict is carried out in that Department where there is the largest quantity of peas packed.

1195. In addition to representing your firm here——?—I am really representing the London Chamber of Commerce.

1196. I was going to ask you that?—Quite so; but I would be very pleased to answer any question in connection with the business at the same time.

1197. On behalf of the London Chamber of Commerce, I think you advocate that a statutory maximum should be

Mr. J. W. Copeman.

20 Nov. 1899.

prescribed in this country in respect of colouring matters generally?—I am speaking more on the question of sulphate of copper and peas. This has been a great trouble to the trade for many years. Preserved vegetables are used freely in all the leading hotels, restaurants, and clubs in London, and they are preserved vegetables in which sulphate of copper has been used to fix the colour. Never a single case has been known to any of us in connection with the trade of anyone having been injured in health by it; not a single case has ever been known of anyone having been poisoned by it. As I say, we challenge the medical profession to produce a single instance where anyone has ever been poisoned by the use of sulhpate of copper in preserved vegetables. There is not a case on record. I have eaten them myself, and I have seen them eaten day after day by friends of mine, and not a single instance has ever been known to happen within my own personal knowledge.

1198. By poisoned, do you mean poisoned in any degree?—I mean any illness whatever. I have never heard of any case of illness from preserved vegetables, and there is no record of any. I may tell you that I have got from time to time in connection with the question of preserved food, the whole of the deaths from poisons from food of every description, and I have a list of all those foods, if it may be of any use to you.

1199. Perhaps you will answer my question before we go further. I asked you whether on behalf of the London Chamber of Commerce you advocated the imposition of a maximum quantity of sulphate of copper?—I do, for this reason. There has never been a defined quantity, and there has never been any legal position with regard to the use of sulphate of copper whatever. From time to time prosecutions have taken place, and in some districts grocers have been fined, and in other districts the cases have been dismissed.

1200. Have they been fined for the presence of sulphate of copper in any quantity?—In almost any quantity before some benches of magistrates. The administration of justice in that respect is so irregular that that is the principal reason why I ask that the Government should fix a proper quantity.

1201. I interrupted you; you were going on to say something else, I think?—I have simply given in this return, which I can hand in if you like—a list of the deaths from foods of all sorts for about nine years taken from the Registrar-General's returns. From this list you will see that there is no record of any death from poisoning from preserved vegetables (*handing in list. See App. No.* 22.)

1202. I see one in 1894 from tinned fruit?—Yes, there is one from tinned fruit, and that is the only record there of a death from eating tinned fruit throughout the nine years, and you see that is for the whole of England for nine years. The list covers deaths from poison by accident through eating food of all descriptions.

1203. You have taken this from the Registrar-General's return?—Yes, I have.

1204. You are aware, I suppose, that there are a great many people who avoid preserved vegetables, if they know them to be coloured?—There may be some. There are people who, through prejudice, avoid eating preserved food of all descriptions—very much to their own disadvantage, in my opinion.

1205. I do not think it is necessary to introduce into your evidence the word "prejudice," unless you wish to?—I would be very pleased to withdraw that at your suggestion, but simply I think that there is amongst a certain portion of the population a considerable amount of prejudice against preserved foods. I withdraw it.

1206. Do you find that the present uncertainty of the law as to the introduction of colouring matter in preservatives has been any detriment to the trade?—It has done a considerable injury to local grocers where they have been fined, not in numerous cases, but in some few cases in Middlesex of late. That is almost the only county where there has been any prosecution with regard to preserved vegetables. It stands to reason that if a local grocer is fined for selling an article which is injurious to health it does him considerable harm in his business. He buys an article, presumably merchantable and fit for food, and he sells it, and then he is summoned before the magistrates and fined, and he must suffer in his reputation in the district. I would also point out that this preserved vegetable trade is a very heavy one, but the larger portion consumed is in hotels and restaurants, steam boats, clubs, etc.—not so much in private houses. One never hears of any trouble where the large consumption takes place; and the unfortunate part of it is that if a lady buys a bottle of peas or preserved vegetables, and uses them for a dinner, served in the same way as her husband would get it at the club, the vendor is liable to prosecution.

1207. Would the Chamber of Commerce, or the trade generally, object to a provision such as you have mentioned existing in some of the American States requiring the notification on every parcel that the contents thereof are artificially coloured?—Not at all. I have stated at the end of my synopsis of evidence that I put it before the Special Committee of the Foods Section; and the trade would see no objection to declaring on the label of such package: "These goods are artificially coloured."

1208. Notwithstanding that that would come as a revelation to a good many customers, I suppose?—I daresay it would in private life. Many people may buy these goods, not knowing that any colouring matter is used, but I think now that these questions have been brought to the notice of the public in the Press, that probably a greater knowledge exists now of the fact that colouring matter is used than existed a few years ago. There is no objection to their knowing the fact, and we in the trade see no objection.

1209. You have mentioned one part in 10,000 as the quantity of metallic copper sanctioned by certain Governments?—Yes, and I have the authority of Dr. Tschirch, who says that it is perfectly harmless when half a kilo per day is consumed of preserved vegetables.

1210. Have you undertaken, or are you aware of, any analyses having been undertaken of goods artificially coloured in this country?—I am aware of many having been made in connection with prosecutions.

1211. I think you have some figures on that?—Yes, I have. You will find that I have handed to you on a separate paper the proportions according to M. Riche's analyses. The highest quantity of metallic copper found there is one in 10,000, and they go on to one in 14,285. I have handed that paper in. (*See App. No.* 20.)

1212. I have it before me, but I want to get the information on the notes, if you will kindly read it?—It is so intricate that really I should have to have Riche's paper, unless you take my figures as representing what Riche says there.

1213. We will take your figures?—0·100 is equal to one part in 10,000; 0·95 is equal to one part in 10,526; 0·090 is equal to one part in 11,111; 0·085 is equal to one part in 11,765; 0·080 is equal to one part in 12,500; 0·070 is equal to one part in 14,285.

1214. Those are the proportions found by M. Riche, as I understand?—Yes, in the different packs of peas which he examined there.

1215. When did he make his analyses?—This was in 1896. The proportion of one part in 10,000, which is the part we ask the Government to fix as the maximum quantity allowable, is equivalent to 2·7 grains, or slightly over, of sulphate of copper.

1216. (*Dr. Tunnicliffe.*) Per kilo?—Per pound of peas. Roughly speaking, the difference, I think, between sulphate of copper and metallic copper is about one in four.

1217. (*Chairman.*) Who is M. Riche?—He is an eminent chemist in Paris.

1218. At whose instance did he make those analyses?—In connection with the Paris Chamber of Commerce, and the Government, too, I believe.

1219. (*Dr. Bulstrode.*) Do you propose to apply this maximum of 2·7 per pound of peas to other vegetables as well. I mean to beans and spinach, for instance, or is it to be applicable only to peas?—There is a larger quantity of sulphate of copper used in peas than in other vegetables.

1220. In peas than in any other?—I believe so. Of course, I am not giving you scientific evidence. I believe, so far as my knowledge goes, that the pea is one of the few vegetables that does not contain copper naturally; I believe there is copper naturally in beans, but there is no copper in peas. I have read so, but I am not a scientific man.

1221. You would be content with this maximum as applied to all vegetables?—Yes, to all vegetables; but there is no probability of such a quantity of copper being used in some of the other vegetables as is used in peas, because it is not so necessary.

1222. You say you would have no objection to its being stated on the label that those goods are artificially

Mr. J. W. Copeman.

20 Nov. 1899.

coloured. Would the trade have any objection to state with what, and how much of it?—It would be impossible to exactly define on the label what is the quantity that the particular package contains. It is done in America. I have seen a label in which a certain portion of copper is mentioned on the label. It would be rather a difficult matter to exactly define the quantity of copper in each package of peas. I think it would be better to say they were artificially coloured, or even, if it was necessary, to say that sulphate of copper was used in fixing the colour of peas; we have no objection to that really. But I think it is hardly necessary to put more than that they are artificially coloured.

1223. Is it not important in investigating, for instance, outbreaks of diseases, or attacks of illness in people, to know exactly what they have been taking? If, for instance, the doctor knew that a patient had been taking say, two lbs. of vegetables—of course, that is a large amount, we will say one lb.—and taking copper with them; it would be a great help to him in investigating the cause of the illness, and it might throw some light upon the effects of copper upon the human system?—It might.

1224. What would be your objection to stating it?—I would have no objection to stating the fact on the label at all, only this, that it is somewhat difficult to secure the exact proportion in a tin of peas.

1225. Would you have any objection to state upon the label that the copper used in the colouring of these vegetables does not exceed 2·7 grains per lb.?—I do not know that there would be any objection to that.

1226. May we take it from the London Chamber of Commerce that there would be no objection?—In the London Chamber of Commerce the feeling we have had in discussing this on the Committee is that we have no objection whatever in stating on the label whether there is sulphate of copper in the peas, nor in saying that the goods are artificially coloured.

1227. All through, where any other colouring matter is used, whatever the colouring matter is, would the trade have any objection to the amount and nature of the colouring matter being stated on the label?—I hardly think that is a thing you can bring exactly to bear in commerce all the way through. As far as I am concerned myself I should think where cochineal is used, and various other articles of colouring, that there is no reason why you should not state on the label that the thing is artificially coloured. I think that would be a good thing, but it would be rather difficult to state the exact amount spreading over a large filling on the package, or anything of that kind.

1228. It would be, perhaps, difficult to state the exact amount in any given portion, but not the percentage amount, namely, that it is coloured with such and such a per cent. of copper?—Or that it is artificially coloured, or with regard to the peas, if you like to say so, that it is coloured with copper.

1229. Perhaps there are certain people with whom certain drugs or certain metals would not agree; is it not important that they should know what they are taking? What would be your objection to having the exact colouring matter placed upon the article?—I have no real objection, personally, only I do not think it is really necessary in regard to the simple articles of food such as you would have served up at a dinner, or in a jelly or anything of that kind. They will give you jelly in which various colouring matters were used, such as cochineal and various other articles which are used for that purpose. Go to piccalilli, there you have turmeric. Turmeric is used in mustard, I believe, and there are other articles. You might have it stated on the label what the colouring matter is, but in ordinary commerce I do not think there is really any necessity for stating the exact quantity.

1230. Have you any knowledge of the use as a preservative of boracic acid, formaldehyde, and salicylic acid?—I have not.

1231. You cannot tell us anything about the preservatives used in jam or bacon?—I am not giving evidence in regard to provisions. I have noticed the evidence given last week, but I am not giving evidence in the provision trade with regard to boracic acid. But with regard to jams I do not know whether drugs are used by some manufacturers; we are jam manufacturers ourselves, we use sugar, and we use colouring matter.

1232. Can you tell the Committee what are the facts in Germany with regard to copper in peas?—I have no knowledge with regard to any injury caused by copper in any country. I think in Germany there are very few greened peas used. They are mostly used for stewing purposes, where they like the peas brown; and in some parts of France they stew the peas *au naturel.*

1233. Are you aware whether the use of copper in Germany is prohibited?—I believe it is in Germany.

1234. How long is it necessary, for the purposes of the trade, that the vegetables shall retain their natural colour, or their approximately natural colour?—So long as they are being offered for sale. As a rule, peas are consumed within two or three years.

1235. Within two or three years?—Yes; sometimes I have seen them held in stock longer; but they deteriorate after that age, as many other goods do.

1236. It would not serve the purpose of the trade if a colouring matter could be used preserving the colour, say, for three months?—It would be no use whatever.

1237. No use?—No, I saw a case the other day, in the case of a prosecution with regard to peas, where a man had had them about eighteen months.

1238. (*Dr. Tunnicliffe.*) Have you a practical knowledge of the colouring of the peas with sulphate of copper—I mean of the actual process?—Of the manufacturing I have not.

1239. You have no knowledge of that at all?—I have no knowledge of it; I have never seen them manufactured.

1240. Then, of course, you cannot tell the Committee what would be the minimum quantity of copper required to keep the colour?—I can tell you this—not from any practical observations on the spot, but from my general knowledge in the trade and through the manufacturers that I have to do with: Of course, it has been an important matter to know what goods you are to receive from a manufacturer, and from time to time, when I have made purchases, I have had to point out the condition of the law here, and ask them to give the very smallest quantity of sulphate of copper consistent with the preservation of the colour of the peas. My opinion is—I believe you were not here when I made the statement—that the minimum quantity necessary is about two grains of sulphate of copper per lb. of peas.

1241. One hundred and thirty milligrammes per kilo; is that not the case?—I could not tell you the figures in the gramme, but I have given them in my synopsis. I believe this—that the general manufacturers use from 2 to 2·7 or 2·8——

1242. Grains per lb.?—Grains of sulphate of copper per lb. of peas. That is the usual quantity manufacturers use.

1243. That would come out at about 100 milligrammes per kilo, as a matter of fact?—Dr. Riche's paper would give you it exactly.

1244. He gives about 100 milligrammes per kilo. How far does your knowledge of preserving peas with copper date back?—Fifteen or sixteen years, I should think—about that.

1245. Not longer than fifteen or sixteen years?—Sixteen to eighteen years, really—perhaps eighteen years.

1246. Have you noticed any appreciable difference in the colouring of peas preserved with copper during that time in, for instance, we will say, France; now mind, my question is: Have you noticed any difference with regard to the colour?—I have not, so far as colour is concerned. Do you say that the copper has given no extra green—is that what you mean?

1247. I did not ask you about the copper; I asked you about the colour?—So far as I know there is very little difference in the colour; I have not noticed any difference in the colour.

1248. For instance, were the peas got from France in 1885, approximately speaking, about the same colour as the peas got from France now?—I should not like to say.

1249. The reason I asked you was this, because in 1880 there was a Commission in France, as you are probably aware?—I am.

1250. That Commission decided that 40 milligrammes per kilo, which would come to very much less than what you have stated, was sufficient to colour peas, and that any amount beyond that was injurious; that was in 1880, you see?—Yes, but that has been since abrogated by another Commission.

1251. Not exactly abrogated, but it has been altered?—I mean to say that there is no restriction whatever in France now; they allow the present system to go on.

1252. My point is this, that if there was no difference

Mr. J. W. Copeman.

20 Nov. 1899.

in the colouring of the peas then when only 40 milligrammes were used per kilogramme, 40 milligrammes should be enough now?—I should say that is simply for consumption in France. I should say that in the peas that were sent to other countries a larger quantity of copper was used. It was not confining it to the manufacturer, but simply to the consumption in France.

1253. That does not materially alter the question, because it is a question of the time the colour will keep?—I will further answer the question in this way: In my opinion the colour cannot be satisfactorily fixed in peas without two grains of sulphate of copper, and I believe myself that many analyses are given by local analysts in the prosecutions which have taken place with regard to peas ,which are much too low. That is my opinion. I used to think otherwise, but my own experience has now changed that opinion. You must bear this in mind, that a manufacturer of peas does not want to put any more sulphate of copper in his peas than is absolutely necessary to fix the colour.

1254. No, but he wants to be quite certain that they will keep a long time—that is the point?—That the colour will keep a reasonable time?

1255. Therefore the point hinges upon what is the reasonable time?—Whether the colour would be very much altered after two or three years? I should not think it would be.

1256. Anyhow, in 1880, 40 milligrammes of sulphate of copper per kilogramme of peas was sufficient to keep the colour?—I believe myself in the case of the peas for ordinary commerce consumed in this country that anything below two grains of sulphate of copper is hardly sufficient. I may say this: We have had four different manufacturers of peas lately who have had their goods brought before the magistrates in Middlesex, and they have been condemned where they have had from 2·3 and 2·4 to 2·6, or about that, of sulphate of copper. There was one other case I saw where a summons was applied for, where I think it was about 1·7; but I very much question whether the analyst is correct in the lower grade.

1257. Copper is a very easy substance to determine the presence of; I mean it is not like an animal poison, and, therefore, the analysis, without you have very definite evidence to the contrary, probably would be correct?—I may say that those of my friends who are thoroughly acquainted with this business have a great deal of doubt as to the analyses of these goods, and in many cases the analyses have given really below the quantity of copper that is in.

1258. (*Chairman.*) Does that not point to an uncertainty in the proportions in various parts of the preparation?—It does; and I may say this: I believe that when these peas are manufactured they are put with the sulphat of copper in a large boiler, and so it would not be perfectly evenly distributed over the whole of the peas; but in one pound of peas you might find a slightly larger proportion of sulphate of copper than you would in another. That is a thing that you cannot avoid, I believe, from what I have heard from the manufacturers themselves.

1259. Do you not recognise some danger in dealing with a strong poison?—It is not a very strong poison, I might say.

1260. Let me finish my question, if you please. Do you not recognise some danger in dealing with such a strong poison, arising from the difficulty of mixing it equally over the fruit or vegetables?—I do not in that instance for this reason, that if an undue proportion of sulphate of copper be put into a pound of peas they would be uneatable, and no one would eat them. If you were to put 4 or 5 grains of sulphate of copper into a pound of peas no one would ever eat them; you could not eat them. Again, I may say I am not a scientific man, but they give from 5 to 10 grains of sulphate of copper as an emetic, doctors say.

1261. (*Dr. Tunnicliffe.*) How much?—From 5 to 10 grains, and I mean to say that if 4 or 5 grains of sulphate of copper were put into a pound of peas no one would ever use them. There is no danger of it in that way.

1262. One would never eat the whole pound?—One would never eat them at all; you could not eat them. If you put in so much as 5 grains of sulphate of copper it would make them so unpleasant in taste that you could not eat them.

1263. You say there has been no evidence of poisoning directly attributable to copper in peas?—Not the slightest that I know of, and the trade ever heard of it.

1264. Are you aware of the enormous difficulty of locating in a complicated meal any case of poisoning to one constituent of the meal; you must be aware that there is great difficulty?—I daresay there would be; there was in the case of the Inns of Court Hotel; they could never find out the cause of death there.

1265. Do you know how much copper is put in the peas by the people who manufacture those peas in Kent?—About the same proportion.

1266. About the same proportion?—Yes. I may tell you this that we had a case the other day relating to some peas preserved in Kent, in Folkestone, by the Folkestone Canning Company. The analyst certified there about 2·6, or 2·65, I think it was. I may say that these vegetables which are preserved in England are usually preserved by Frenchmen employed for the purpose.

1267. Suppose a statutory restriction of one half the amount you give, for instance, down to 1·5 grains per lb.; would that appreciably affect the trade?—It would be impracticable, I believe myself. I honestly think so. Unless you have a larger quantity of sulphate of copper the colour would not be retained.

1268. How long do you think a pound of peas containing 1·5 grains of sulphate of copper would keep their colour?—I really have no data to go on.

1269. Have you tried, or has the Chamber of Commerce tried, to make any experiments of a scientific nature upon this subject for themselves?—No. The Chamber of Commerce, I believe, have made no experiments. We have got all these particulars of M. Riche from France, which I think is the most important evidence I have ever seen in connection with preserved vegetables. The London Chamber of Commerce, as far as I know, has never employed any analyst to go into the general quantity of copper in preserved vegetables as sold in this country.

1270. Do you not think it would be a good thing if they were to employ somebody to find out the minimum amount of copper required to fix the colour of peas for, say, two years?—I see no objection to our making the experiment. I should be very pleased to bring it before the Committee to do so.

1271. You see there must be some little difficulty in the case, because the French law has changed very much, and there have been very great restrictions in all countries with regard to this subject?—Yes, and in America too; but they have been altered, I quite agree.

1272. It may be quite possible that a minimum, very much under the minimum that you give, will keep the colour of peas for two years; you know nothing to the contrary, I mean?—I know nothing to the contrary; I simply give you the knowledge that I have gained from the people who manufacture them. As I say, they are not anxious to put in any more sulphate of copper than is necessary, and they think that from 2 grains to 2·7 per pound would be the proper quantity to use to really safely preserve the colour. That seems to be the quantity usually observed by the manufacturers generally.

1273. You do not know about the process of the manufacture?—I have never been present at the manufacture.

1274. You do not know how the copper is mixed with the peas, or anything of that kind?—I do not know that. As to the effect of eating these goods, I have myself seen any quantity of them eaten. I may tell you that in the City sale room, where we have samples opened in any quantity, and the staff usually taste all round—many and many a time any quantity of peas we have had opened there, and they have been eaten; but we have never had the slightest illness reported in any of our staff or anyone who consumed those goods.

1275. Would anyone ever eat more than half-a-pound of preserved peas? I think not.

1276. I submit that a vegetarian would eat more, and vegetarianism, we are informed, is on the increase?—I believe it is. Dr. Tschirch says that if a man eats half a kilo a day, which is a pound and a tenth, there is no damage to his health by one part in 10.000. I think no one is likely to eat one pound of preserved peas.

1277. I suppose dried peas are always used for pea meal and pea soup, and those sort of things?—Yes, and there are natural green peas that are used in soups, you know, very largely in the trade—dried green peas. The dry marrow-fat peas are sold largely for that purpose.

1278. They are used whole?—Yes, they are.

1279. The pea-meal peas——?—They are the ordinary dry peas.

1280. (*Chairman.*) You have put very clearly before the Committee your belief, which I have no doubt is well

Mr. J. W. Copeman.

20 Nov. 1899.

founded, that the public would never discriminate between colourless and coloured articles in favour of the former?—Certainly, they prefer them coloured, and we have to give them coloured goods in many instances.

1281. I would ask you whether the trade would suffer great inconvenience supposing the use of colouring matters were prohibited altogether?—It would in many districts—for instance, even going outside the grocery trade, if I may so point out there is one district where people will have nothing but pale cheese, and there is another district where they will have nothing but red cheese. You have to give the people what they ask for and what they wish for.

1282. In that case you are not using a poisonous matter for colouring, you are using annatto—is that not so?—It is annatto there.

1283. I should have put my question differently. I should have asked if the use of strong poisons as colouring matters were prohibited altogether whether the public would not become reconciled to buying those things off colour?—I may say this, that I have absolute knowledge of the sending out to the grocery trade of vegetables *au naturel*, in which no colouring matter is used, and over and over again they have to be returned to the wholesale houses as the retailers cannot sell them; the public will not use them if they are of a brown colour; they will have the peas green.

1284. Quite so, as long as they have the choice?—They have the choice, and they go for one or the other. The fact is the others are put before them, they see them, and then they will have them green. A cook will not use the others. You send a French cook a tin or bottle of peas *au naturel*, he will not use them, he will send them back, he will have them green.

1285. That is as matters stand at present, but I am putting the case supposing the colouring of peas by mineral substances was prohibited?—Then they would go out of consumption. The fact of it now is the trade at this moment is very disorganised through the prosecutions in Middlesex in this last two or three months. There have been very few prosecutions in the other districts, because, I think, the authorities feel it is a mistake to go on prosecuting a grocer for selling an article in which no injurious effect has been proved to have taken place. But in Middlesex in these last two months there have been several cases of prosecutions for selling peas containing poison—sulphate of copper, as they call it—and the result of is is that there are firms in London now that have large stocks and cannot get rid of them. If you were to do away with the use of colouring matters in peas—and sulphate of copper is the only thing that has been successful—I say the trade would be ruined, absolutely ruined—and that is a very large business.

1286. Do you think the people would rather eat no peas than brown peas?—They will not eat brown peas.

1287. (*Dr. Tunnicliffe.*) They need not be brown?—They would be yellowish brown.

1288. Come, now, I think I should put it dark green?—No, I would call it a yellow brown. If you would like me to send you a tin or two up I will with pleasure; I have them. I call it myself a yellowish brown, not green.

1289. How long will they keep—have you much knowledge of the Paris restaurants?—I have not. I know this, that I have been to Ostend, where peas coloured with sulphate of copper are not supposed to be used, but there you will find them in every restaurant. I know the leading restaurants would not give you peas that are not green. There is any quantity of greened peas consumed in Belgium.

1290. There are a certain number of peas in Paris which are naturally dark green; these peas coloured with sulphate of copper are of a bright green, are they not?—Fairly bright—not glaringly bright, I should say.

1291. In Paris there is an amount of peas about of an ordinary dead green?—Is that so?

1892. (*Chairman.*) I think there is no doubt that what you have said is the case, that uncoloured peas are a pale brown?—I would say this—these goods are consumed every day in the large hotels, restaurants, and clubs in London, and we never hear any complaints.

1293. (*Dr. Tunnicliffe.*) Do you ever have any peas coloured with sulphate of copper going wrong?—I have seen peas that have been kept a number of years that are very thick and cloudy, and such as I would not like to eat—peas about seven or eight years old.

1294. What colour were they?—They have been very messy through being thick; the juice had become mixed with the peas.

1295. You have never seen any peas coloured with sulphate of copper going wrong?—Really bad?

1296. I do not necessarily mean bad; I mean not a bright green—not a good green?—No. Of course, I have seen peas where I considered an excess of sulphate of copper has been used, which I would not eat myself; I have known such cases. Some years ago I have known peas sent here with certainly too much sulphate of copper in them, and I would not have eaten them. I mean there was a metallic taste with them that you can detect. That is why I say if you put five grains of sulphate of copper in a pound of peas no one would ever eat them at all. If you were to go into a leading restaurant in London to-night, or into some of the leading clubs, you would find three or four dishes in which preserved vegetables were served, in which sulphate of copper has been employed to fix the colour.

1297. (*Chairman.*) You have frequently remarked that in spite of the general use of preserved vegetables in clubs and hotels in London no complaint is ever heard of their effect upon the consumer?—I have never heard of it.

1298. Are you aware that in a recent well-known case of poisoning in a London hotel doubt was thrown upon the vegetables?—I do not think there was the slightest proof. There was a doubt thrown on the apricots, but then it was absolutely proved that some few of the patients the doctor had treated had never eaten any apricots at all. They never traced it; it was an open verdict; virtually they could not find out the cause. I never saw it really suggested in that case that the coloured vegetables had anything to do with it. Not in the case itself. There was a remark made by an inspector in a pea case that such might have been. That is all I know. I think that Inns of Court Hotel case is a very serious case—I presume I ought not to mention the name though—but in that case it is very much to be regretted that the cause of death was never discovered.

1299. (*Dr. Bulstrode.*) Do you know that sulphate of copper is used as an astringent in much smaller doses than as an emetic?—It is used, I believe, medically in cases of extreme diarrhœa. I must not give doctor's evidence, I suppose, but it is used there from half a grain to two and a half grains, I believe.

1300. You have given a lot of evidence, which is by the way of being medical, and therefore I think we should point out that there is no reason why the public should be dosed with what is a drug when they do not require to be so dosed?—Just so.

1301. There may be many conditions when it is not desirable that the public should have an astringent administered to it, and yet you see no objection to promiscuously administering such an astringent; does that not occur to you to be at any rate one point in the matter?—I would just point out this: Suppose a person in the condition you name ate half a pound tin (10oz., without water) of peas; there would be about 5oz. of peas, and the quantity there would not be more than three-quarters of a grain or one grain of sulphate of copper.

1302. Are you aware that the pharmaceutical dose of an astringent is from a quarter to two grains?—Yes, I am; but I should decidedly think if persons were considering their condition when they were told not to take any astringent, or anything of that kind, they would be rather particular about their food, and would not eat any green peas at all, whether out of a garden or out of a tin.

1303. That is one reason why I asked you what objection you would have to the exact nature of the colouring matter being put on the package?—I said I had no objection.

1304. Somewhat reluctantly, I think?—No, I think not; the only reluctance was as to stating the exact quantity, because there would be a difficulty in doing that. I am not reluctant to say what is in the tin. I do not remember any objection to that. I should say this about the trade. I certainly can speak for the London Chamber of Commerce, and we have no objection to say simply, as I put it in one form, that these goods are artificially coloured, or that they are coloured with sulphate of copper. I should have no objection to that; the only objection, and I really regret it if I did not make myself understood, was that we have some difficulty in saying the exact quantity that there is in a particular package.

1305. (*Chairman.*) Is there any general statement which you would like to make?—I do not think there is any more than I have given you in my evidence. I wish that you would kindly take into consideration those remarks made by medical authorities in the course of the litigation we have had.

1306. That is not your evidence?—No; those are extracts from cases which I verify. I give you there the different cases, and if you would like even the shorthand notes I could get you those particular doctors' statements in some cases. I should like you and these gentlemen to take that into consideration, because, I think, that is of some importance in connection with this question of colouring matters.

Mr. J. W Copeman.

20 Nov. 1899.

Dr. J. Howard Jones, D.Sc., M.D., called; and Examined.

Dr. J. H. Jones, D.Sc., M.D.

1307. (*Chairman.*) You are Medical Officer of Health for the County Borough of Newport (Monmouth)?—Yes.

1308. And you are prepared to give us some information on the action taken by the Town Council with regard to the use of preservatives?—Yes.

1309. Would you kindly make your statement?—It being evident that during the last few years large quantities of food preservatives have been added to many staple articles of food, particularly hams, bacon, preserved meats, butter imported from Ireland and the Continent, and milk, and that many individuals would thus be unconsciously taking considerable doses of drugs daily, whilst the necessity for the drugging, especially of butter and milk, has not been proved, inasmuch as butter can be shipped into this country from long distances in a perfectly fresh state without the addition of preservatives, and as milk collected in properly sterilised vessels and rapidly cooled in refrigerators will remain sweet long enough for distribution at even considerable distances, and that, therefore, the use of boric acid and its salts, formaline, etc., was not only unnecessary, but a source of danger to the health of consumers, particularly children and invalids, inasmuch as milk is the main diet of the sick, and further the use of such preservatives was a direct encouragement to neglect those precautionary measures which are absolutely necessary for the preparation of clean and wholesome articles of food; therefore, being of such opinion, when the Borough Analyst reported to me verbally the existence of boric acid in several samples of milk analysed by him, and further certified on March 8th, 1898, that two samples of butter contained respectively 0·71 and 0·74 per cent., I reported the matter to the Sanitary Committee. The following are the minutes of the Corporation dealing with the matter:—"March 15th, 1898.—The Medical Officer of Health reported to the Sanitary Committee that it was customary to use boric acid in butter and milk, etc., for preservative purposes, and that an excessive quantity was injurious to the public health; he, therefore, considered it desirable that the amount allowed to be used should be limited, and that dealers should be notified to this effect, after which proceedings should be taken if the practice were persevered in. *Resolved:* That this Committee, being of opinion that the custom at present obtaining of drugging many staple articles of food with so called preservatives, is a source of danger to the health of the community, especially in the case of children; they, therefore, instruct the Town Clerk to notify milk vendors and other dealers to the effect that no boric acid or other analogous preservative will be allowed in milk, and the discovery on analysis of the existence of such preservative to any appreciable extent in butter, creams, prepared meats, and other articles of food, will render the vendors of such commodities liable to prosecution."——"May 17th, 1898.—A deputation from the Grocers' Association, consisting of Messrs. J. F. Saunders (president), Alfred Williams, Hollingdale, Lawrence, Frost, Hall, Gower, Watkins, Farley, Matthews, Adams, and W. Hunter (secretary) was introduced by Councillor Cordey, to interview the Committee on the subject of the use of boric acid as a preservative in foods. The deputation was accompanied by Mr. A. J. Giles (secretary of the Grocers' Federation), and Mr. Erstley, an expert on boric acid. Messrs. J. F. Saunders, Alfred Williams, and A. J. Giles addressed the Committee, and asked that no proceedings should be instituted until the Government had fixed the maximum quantity of boric acid to be allowed. The chairman pointed out that the resolution of this Committee on the subject merely instructed the Town Clerk to notify milk vendors that the use of boric acid in milk would render them liable to be prosecuted, and to other dealers that its use to any appreciable extent would have the same effect. Proceedings would not be taken in respect of butter, bacon, preserved meats, etc., unless it was considered that the quantity of boric acid used was injurious to health. The deputation, after thanking the Committee for their attention to the matter, then withdrew. Resolved.—That this Committee see no reason for altering or amending the resolution already arrived at on the subject." On April 23rd, 1898, I gave evidence at Pontypool Police-court on behalf of the County Council of Monmouthshire, in a case of butter adulterated with 1·3 per cent. of boric acid, to the effect that that quantity was both unnecessary for the purpose of preservation, particularly at that time of the year, and was likely to be followed by injurious effects upon the health of children or invalids partaking of it.

1310. What proportion do you consider is harmless, or what proportion is recognised by your Town Council as harmless?—We have not decided upon any proportion. It is a difficult matter to decide as to the real limit, and we have not cared to take upon ourselves to decide upon a maximum.

1311. The Council on the 17th May resolved that proceedings should not be taken in respect of butter, etc., unless it was considered that the quantity of boric acid used was injurious?—Any case such as this one of 1·3 would be followed probably by prosecution. The largest we had was 0·74, and we did not feel justified in proceeding in that case.

1312. That does point to some proportion that you recognise as harmless?—We did not consider this was harmless, but to decide the matter in a court of law is a different thing. We did not care to go to court unless we felt certain of winning the case.

1313. Then you object to the presence of boric acid at all?—I would object to it altogether in milk, and I certainly object to the use of it unknown to the public in articles of food.

1314. Have you ever observed any bad effects arising from its consumption?—I have no personal experience, and so, of course, I have simply read the literature on the subject.

1315. What countries are referred to as the origin of the butter, which comes in a fresh state without any preservative?—I understand it has been imported from Australia without any preservatives, and Danish butter, I understand, as introduced into this country, contains no preservative in the way of boric acid. That is what I have gathered from conversations I have had with analysts.

1316. (*Dr. Tunnicliffe.*) Evidently you have not had any cases of any ill-effect arising from the addition of any preservative to food in your individual experience?—I have no private practice now.

1317. Would not a case occurring come under your notice?—A case has occurred in Newport where a medical man was attending a patient for dyspepsia.

1318. That is the sort of thing I mean; you say there was a case of dyspepsia which has been attended by a medical man?—Yes. He found the remedies did not have any effect, and so he suspected the food as being possibly the cause. He therefore had several of the articles of food analysed. He found that two or three of the articles, particularly the butter and the milk, contained considerable quantities of boric acid. These were immediately stopped, and supplies procured which were free from the acid; and then the symptoms abated. He claimed that as a case where there was an injurious effect produced by the use of boric acid. He was very positive on the point.

1319. (*Chairman.*) May I ask who was the patient?—The patient was a delicate lady. The case was quoted in the police-court of Pontypool.

1320. (*Dr. Tunnicliffe.*) What was the result of the Pontypool proceedings in 1898—you gave evidence there, I think?—Yes; the defendant was fined in that case; I forget the sum—it was £5, I believe. The magistrates came to the conclusion that it was injurious to the health of the community to use such large quantities of boric acid.

1321. It was injurious to health?—To the health of the community—that it was a source of danger to the health of the community.

1322. What was the amount used in this case?—Ninety-one or ninety-three grains in the pound, which was 1·3 per cent.

1323. In the case of this delicate lady who was suffering

Dr. J. H. Jones, D.Sc., M.D.

20 Nov. 1899.

from dyspepsia, were the foods which were analysed for boric acid analysed for any other constituent?—I believe so; they were not analysed especially for boric acid; they were analysed for any preservatives.

1324. For any preservatives?—Quite so.

1325. Were they analysed for any other class of modern preservatives?—They were analysed for any poisonous metals.

1326. They were not analysed, for instance, for ptomaines, or for volatile bases, such as cadaverin or putrescin?—No, I do not expect so. There was no reason to suspect a state of putrefaction in the butter and so on.

1327. Of course those substances are present in food, only you could not smell them or even taste them?—Quite so.

1328. Have you had any case under your immediate notice of poisoning due to the presence of such substances in food?—I have in the case of pies, some years ago.

1329. Do they roughly similate the symptoms caused by boric acid?—I should say not; they are acute.

1330. Is not diarrhœa and vomiting one of the symptoms of ptomaine poisoning?—Yes, coming on acutely after eating a particular article of food; that is my experience of it—after probably one meal.

1331. What are the symptoms of boric acid poisoning, as far as you have seen them?—I cannot give you any personal experience; it is simply text-book experience.

1332. But you do get diarrhœa and vomiting?—Yes, you do get diarrhœa and vomiting.

1333. The only difference you would say was that if the poisoning is of a chronic nature, the symptoms are chronic in that case?—There is the low temperature which is not often the case in ptomaine poisoning.

1334. Is it not often the case?—You may get a temperature with ptomaine poisons, and if it is a case of boric poisoning, probably there would be no rise of temperature.

1335. You do get a temperature with boric poisoning, do you not?—No.

1336. If you gave us a case of chronic ptomaine poisoning it would very much resemble that of chronic boric acid poisoning, would it not?—Yes, I should think so. I might mention that this case was the case of a well-to-do lady, and that she had plenty of money to buy fresh food with. It was not a case of potted meats.

1337. It was a case, I suppose, of whether the food was fresh?—Quite so.

1338. I mean we can argue in a circle, can we not?—Yes.

1339. With regard to Australian butter, you say you have heard—but you have simply heard—that it is imported without boric acid?—I heard it on the authority of Dr. Hill, of Birmingham. He has made the statement on several occasions. He is the public analyst for the city of Birmingham.

1340. You have made no analysis yourself?—No.

1341. You have mentioned, but not on your own individual observation, that there has been Australian butter imported into this country without a preservative?—I cannot give it as evidence.

1342. This question of the consumption of butter is a very difficult question, is it not?—Quite so.

1343. You have no sort of knowledge how long butter is kept in shops?—I understand now that it is kept as short a period as possible, because it is so easy to get fresh supplies in. They do not keep more than a week's stock, I should say, in most grocer's shops.

1344. Have you ever in your capacity traced the history of any given lot of butter?—I have not had occasion to do so in any instance.

1345. That would fall to you in your capacity of medical officer of health, would it not?—Quite so; but I know that a large amount of the butter sold in our particular town is produced in South Wales and Monmouthshire.

1346. That is the butter sold in Newport?—Yes; and then, of course, the butter would be consumed within a week of being made probably.

1347. What sample of butter was it which was analysed in the case of the dyspeptic lady, which was supposed to have caused those sysptoms—do you know what kind of butter it was?—I could not tell you the kind.

1348. You could not tell us that?—I could not tell except that it was bought as fresh butter.

1349. What other foods were supposed to be eaten which had boracic acid in?—I have been making inquiries among butchers and pork butchers.

1350. I mean in the case of this particular lady?—I beg your pardon; there was some preserved fruit.

1351. She was taking preserved fruit, too?—I believe it was preserved pears.

1352. She was taking that too?—I believe there was a sample of preserved fruit analysed in the case.

1353. It is rather an odd thing for a patient with dyspepsia to take preserved fruit, is it not?—They are the worst people to deal with, I should say, in the way of diet; they fancy all kinds of things.

1354. What would the preserved fruit contain?—I believe it was pears.

1355. What preservative did it contain?—I believe it was boric acid.

1356. Boric acid?—I believe so, but I could not swear to that.

1357. Do preserved fruits and jams usually contain boric acid, in your opinion?—No, I do not believe they do.

1358. They usually contain salicylic acid, do they not?—Yes, I believe they do.

1359. Then this must have been an exceptional case?—Yes, I understand so.

1360. Any other food?—I could not say. I was paying more particular attention, I remember, to the butter and to the milk.

1361. You say that the addition of preservatives is unnecessary Why do you say the addition of preservatives to butter is unnecessary?—If it can be transhipped from Australia to this country in a fresh state by means of cooling and being kept in refrigerators, and if we can get meat from Australia without any addition of any preservatives, I do not see why we could not get butter brought into this country in a perfectly fresh state.

1362. Now, with regard to the second statement, that it is rather apt to cause neglect of precautionary measures which are absolutely necessary for the preparation of clean and wholesome food—what do you mean by that?—I refer there more particularly to milk. I have more knowledge of milk, but the same holds good, I believe, in the case of butter.

1363. Have you ever seen in your experience as medical officer of health a sample of milk which was, I will not say unquestionably, but which was distinctly bad, and yet contained a preservative?—Milk?

1364. I say milk, because you say that you refer specially to milk?—I have seen cases of butter.

1365. I will ask about that afterwards. You have never seen a case of milk?—I have not done the analysing of the milk, so, of course, I do not speak as an analyst on the question. My knowledge is simply derived from conversations with people who deal in milk—dealers and farmers in the surrounding districts. I have had some conversation with those people, and from that conversation I have come to this conclusion, that it is apt to produce carelessness in the way of sterilizing and cooling, and a neglect of precautions which would otherwise preserve the milk.

1366. Do you believe that a sample of milk might be consumed of a certain degree of badness—plus boracic acid?—Quite so.

1367. Wait a minute—which would be refused without boric acid; that is the point, you see?—Milk which is already partly bad?

1368. Granted that you have a certain sample of milk, which we will say presents certain evidences of decomposition—I do not mean gross evidence of decomposition, but certain evidence of decomposition—do you think that individual sample might be consumed by the public if boric acid were added to it, whereas it would be refused by the public if boric acid were not?—Yes; if milk is beginning to decompose, the addition of a sufficient quantity of boric acid would undoubtedly prevent further decomposition.

1369. Would it prevent the decomposition that was present being detected?—If it were very slight.

1370. It might do?—I believe so, because some people have very vague ideas what fresh milk really means.

Dr. J. H. Jones, D.Sc., M.D.

20 Nov. 1899.

I should probably detect the slightest decomposition in milk, and should refuse to take it.

1371. Do you think the ordinary public might be induced to take a sample of milk which was partially decomposed by virtue of the fact that it contained boric acid which tended to mask it—that is an important point?—Do I understand by masking, something that saves it from further decomposition?

1372. No; something which prevents the decomposition which is present being detected by the ordinary person?—I could not go so far as to say that boric acid would mask such decomposed milk.

1373. It would not mask it much in your opinion?—No.

1374. Nor would it arrest decomposition if it had once set in, would it?—I should say it would arrest decomposition if it was only a very slight decomposition.

1375. I want to know if you are speaking upon the result of experiments made by yourself?—No.

1376. Because we have had evidence to the contrary?—Of course, it depends on quantity, and I presume there the quantity would be too large. I presume that 1 in 30 of boric acid would prevent further decomposition wholly.

1377. (*Dr. Tunnicliffe.*) I should think it would, certainly?—Yes; but that would be over 3 per cent.

1378. Now, with regard to the butter, would you tell the Committee what your observations with regard to the butter are in this connection—I mean have you seen any rancid butter containing boric acid?—I have. I had a conversation with the public analyst of the County Council of Monmouth on Saturday on that point. He has a case which is coming on on the 12th December in which there is 1·64 of boric acid and borax, and the butter is rancid.

1379. Was that consumed?—It was bought at a grocer's shop. The conclusion we both arrive at is that the butter had begun to go, and that the dealer thought probably he would save it by making it up again, and put in a preservative because it was rancid.

1380. I suppose it is the most difficult matter possible to get exact information with regard to the history, as I said before, of that sample of butter—for instance, you would not know how long it had been in the shop, or anything about it, I suppose?—We do not know at present; of course, it will come out probably in evidence.

1381. Has it caused poisoning?—No; this is a case brought by the ordinary inspector under the Foods and Drugs Act.

1382. Did anybody consume this sample of butter?—Not this sample, because it was sent to the analyst.

1383. Did anybody consume some of this lot?—Quite possibly. Of course, there is no evidence yet, as the case has not been tried.

1384. There were no complaints with regard to it having caused any poisonous symptoms?—I do not think so. It was bought in the usual course of events.

1385. At present the authorities at Newport would probably pass 0·75 of boracic acid in butter?—We would pass it for this reason—because we are afraid of the result in the police-court.

1386. (*Dr. Bulstrode.*) In reference to this case which you were telling us of where dyspepsia was supposed to have been either caused or perpetuated by taking boracised butter and milk, was any investigation made as to the distribution of that same sort of butter and milk—I mean as to the extent to which the butter and milk from the same source with the same amount of boracic acid in it was being distributed in Newport?—The case did not come to my knowledge until some time afterwards; of course as regards myself there was no inquiry.

1387. In the absence of an investigation of that kind, would you be inclined to attach very much importance to this case?—I simply give it as an individual case. Doubtless there is a large quantity consumed without any ill effects, but cases do arise where it is suspected.

1388. In this case the food supply—the source of the supply of butter and milk—was changed?—Yes, I believe so.

1389. So that really, although they get no boracic acid and no preservative, they might have got some other preservative for all you know?—The new supply was submitted to the analyst.

1390. And it did not contain boracic acid?—He did not find any preservatives in it.

1391. I think the most interesting part of your evidence is as to what effect this enactment on the part of the Newport County Council is having upon the food supply of Newport. Could you tell the Committee what steps you take to ascertain whether these views on the part of the Council are being respected or not?—I have had no notification from the analyst that the samples lately submitted contained boric acid. I went round to some chemists in the town to inquire as to the sale of boric acid, and the general opinion I had from them was that there was a great reduction in the quantity used.

1392. Is the preservative purchased or used by the Borough people in Newport purchased as boric acid from the chemists there?—It is procured as some preservative preparation.

1393. And the evidence of the chemists was that the sale of preservatives was going up?—Quite so. I have reason to think that they have changed the kind of preservative. This notice is given to me by one chemist; it was supplied to the chemists and the people in the town just after the action taken by the Newport Corporation:—"To the Dairy Trade. As the authorities are now so strict on the dairy trade for using boracic acid preparations in their milk for the purposes of preservation, it is most essential that the trade should protect itself by using 'Schering's Formalin Solution,' which is a guaranteed article against prosecutions, prepared under the control of Dr. Rideal, Public Analyst and Examiner in Chemistry to the Royal College of Physicians, and sent out on a scientific basis by the manufacturers themselves, who are well known eminent chemists. But this guarantee is not given to customers who purchase from irresponsible parties who style themselves manufacturers, but who really are not chemists at all, and therefore cannot know the chemical or physiological action of these solutions after they have been put in the milk."

1394. I understand from that that the effect of these enactments on the part of the Council is apparently to lead to an increased sale of another preservative, and to a diminution in the sale of boric acid?—That is the conclusion to be drawn.

1395. You say that you have no other evidence except that; I rather think that in your last annual report I noticed that the use of preservatives had considerably diminished?—Yes; that is stated upon general evidence from our pork butchers. The leading pork butchers, I understand, have given it up. The men added considerable quantities before; one in particular told me that he was in the habit of adding four ounces of this preservative in 40 lbs. of sausage meat.

1396. (*Dr. Tunnicliffe.*) Four ounces in 40lbs.?—Yes; 0·6 I think it comes to.

1397. (*Dr. Bulstrode.*) Of what preservative?—Boric acid—at least it was a boron preservative.

1398. Can you specify the preservative?—I can give you the name—it was glaciarine; boric acid he called it, but of course they have a special preparation.

1399. Where does the borough of Newport draw its chief supply of milk and butter from?—The milk comes chiefly from the county of Monmouth, and a large quantity comes from the moors just adjoining Newport on either side between Newport and Cardiff and between Newport and Chepstow.

1400. And butter, too?—The best class of butter comes from there—the so-called fresh butter, no doubt. There is a large quantity of Danish butter sold, and in the small shops I believe there is a good deal of Irish.

1401. What steps have been taken to ascertain the amount of preservatives in food in Newport at the present time; what is the extent of the analyses made?—There is not so much as I should like; 100 samples are taken at present at random.

1402. Is that all?—That is all; they are chiefly butter and milk.

1403. And in spite of the special enactment, no more samples have been taken?—The samples have been increased in the last twelve months. The new arrangement with the public analyst is that a minimum of 100 samples should be taken, but previous to that—that is, before 1898—I believe forty to sixty were taken. I may mention that the analyst reported to me verbally, and I have reason to believe that when there were small quantities he did not put them down on the certificates.

Dr. J. H. Jones, D.Sc., M.D.

20 Nov. 1899.

1404. What is the population of Newport?—It is 73,000 this year.

1405. Are no preservatives at all allowed in milk and cream in Newport?—We should prosecute in the case of milk if we found it in milk.

1406. But you only look for it to the extent of 100 samples per annum, is that so?—That is so at present.

1407. (*Chairman.*) Do you take any note of other substances besides preservatives in food, such as colouring matter?—We have not taken any notice of colouring matters; I have not troubled much with them. So far as I know, there have been no complaints of any kind from the public.

1408. Referring to that printed notice that you handed in, do you or your Town Council regard formaldehyde preparations as preferable to boracic acid?—There is no clinical experience yet as to the action of formalin in very small quantities, as far as I know, but personally I consider it a very powerful chemical.

1409. You would not institute a prosecution if you detected it in a sample of milk?—I should not institute it, because we should probably lose the case; I do not believe in going into court with unsuccessful cases.

1410. You have no reason to suppose that it is preferable to boracic acid?—No.

1411. I mean less noxious than boracic acid?—I have no reason to suppose so, because it is a very powerful chemical, even 1 in 1,000.

Dr. R. B. Wild.

Dr. Robert Briggs Wild, called; and Examined.

1412. (*Chairman.*) I think you come from Manchester?—Yes.

1413. May I ask if you hold any public office there?—Yes, I hold the appointment of Honorary Physician to the Manchester Hospital for Skin Diseases, and Honorary Medical Superintendent to the Cancer Hospital, and I am Assistant Lecturer on Materia Medica and Therapeutics at Owens College, Victoria University.

1414. Your observation has led you to form certain inferences as to the action of boracic acid?—It has.

1415. Would you state them?—Shortly or at length?

1416. If you go on too long we will stop you?—My attention was called to the subject originally by the case of a patient of mine which I have published already. I sent a copy of my paper to the Committee some little time ago. That case occurred about three years ago. Since then, I have watched the effect of administering quantities of boracic acid to myself in various doses and to various patients to whom it was given for the cure of different conditions; and I have noted the results that I have obtained in this way. I found that I could take small doses of boracic acid myself—that is to say, quantities up to about ten grains at a time—without producing any effects whatever.

1417. Taken with food?—I have taken it both ways. I have taken it immediately after meals, and I have taken it on an empty stomach. I have usually taken it simply in water, but I have also taken it in milk or tea, or something of that kind. It is almost a tasteless substance, and there is no difficulty in taking it whatever. I have taken larger doses, from fifteen to twenty grains, and I find that a single dose of this size does not affect me at all injuriously in any way, but after taking repeated doses of this size——

1418. Daily doses, do you mean?—Yes, daily doses, for a period of a week or perhaps a little more (which I have done several times). I certainly do notice a little disturbance in the stomach of rather an unpleasant nature—nothing very serious certainly, but a little discomfort after food, a little loss of appetite and a little flushing of the skin—a feeling of not being quite so well. These symptoms have practically disappeared in a day or two after ceasing to take the drug. I have also taken on several occasions still larger quantities—quantities up to 120 grains. That is the largest amount I have taken. I took that within three or four hours, and I had very definite effects produced in the way of nausea, discomfort and diarrhœa, which lasted for a day or so, and I was feeling unwell for a day or two afterwards. I had a feeling of loss of tone altogether. Of course, I cannot say whether that was simply due to the diarrhœa or was the direct effect of the acid, because one had the two factors there.

1419. How is the acid got rid of from the system?—I find it is got rid of by the kidneys in my own case, and my observations agree with the published observations of other medical men. I have examined my own urine carefully a number of times, and I find a little difference in the way the drug is got rid of, as to whether the dose is a large one or a small one. When the dose is a small one I find that there is no free boric acid in the urine. The urine is slightly alkaline, and the boric acid is excreted in the form of a combination, with sodium most likely, or with some other alkaline metals. There are several alkaline metals, of course, in the urine, including a large amount of sodium; but all one can say is that the acid is excreted not in the form it is taken—as a free acid—but in the form of an alkaline salt. Borax, of course, is the most likely one. It might be a borate of ammonia, or a borate of magnesium, both of which are present in the urine. But at any rate with small doses of 10 or 15 grains I had no free boric acid in my urine, but only alkaline borates. In the case of a large does I found free boric acid in the urine. Undoubtedly the boric acid which was taken was too much to combine with the alkaline bases in the body, and was, therefore excreted unchanged. But after removing all the free boric acid from the urine I found that there also were present alkaline borates—exactly the same as if I had taken a small dose. That was the result of my analysis, which was not a quantitative one. I could not say exactly how many grains, for instance, were excreted in the form of a free acid, and how many grains in the form of the alkaline salts. I found the acid in the urine within four hours of taking the first dose; I found it 24 hours after taking the last dose, and at the end of about 40 hours boric acid had disappeared from my urine; that is to say, that it took somewhere between 24 and 40 hours for the boric acid to be removed from my body after I had taken a considerable quantity of it. The time was about the same in one case after I had taken 15 grains each day for about 10 days, and then ceased taking it, and kept my urine for the next two days; and the time was also the same when I took a large quantity within four hours—there again it took nearly 40 hours in order to get rid of the boric acid from my body.

1420. Now, as to your observations of other persons?—I have not ventured to give anyone else quite so large a dose as I took myself, but I have kept patients on boric acid for some little time in varying doses—in 5 grain doses given two and three times a day, in 10 grain doses given two and three times a day, in 15 grain doses, which I have given two, three, and four times a day, and in 20 grain doses, which I have also given up to four times a day. In one case the drug was taken continuously for over four months in 9 grain doses.

1421. Were those healthy persons?—Two or three were healthy persons; many of them, of course, were patients, that is to say, they were people who were suffering from some form of disease for which boric acid is given internally. I found that the majority of those patients could take the boric acid perfectly well without any bad effects occurring, and in many cases with considerable benefit to the disease from which they were suffering.

1422. Have you noted any instances where injurious effects arose?—Yes, I have, several cases. One or two cases were especially marked. In one case the drug was given for—perhaps I need not mention the disease for which it was given; it was given and continued, however, for a particular disease; between three and four weeks after the patient had taken 10 grains three times a day he commenced to suffer from an eruption on the skin of a very severe nature, gradually spreading from the palms of the hands to the body, face, and head; his hair commenced to come off, and nearly the whole surface of the skin was red and covered with thick scales.

1423. What was the dose in that case?—Ten grains three times a day—that is 30 grains per day. The boric acid was stopped, and I might mention that at that time I had no idea that the disease was due to the boric acid.

1424. Was that an adult?—It was an adult, a man of thirty-six. The boric acid was stopped, and the disease got well. At that time, as I say, I had no idea of the cause of the disease. Four or five months later, however, the disease recurred—the original disease from which the patient suffered, that is—and he again commenced to take the boric acid. After three weeks, the symptoms again came out the same as before, but this time they were much more pronounced. He took the same doses, but he took them for a longer period of time. He took the drug for several months. I saw him in October, 1896. He was then covered over with a similar eruption to that which I have already described to you. The hair on the head was almost entirely lost; the hands and the feet were covered over with thick scales; his general health had gone down very much; he had lost flesh and got thin; he had lost his appetite; and I regarded him as being in a very serious condition. I at that time had been reading the paper by Professor Féré, of Paris, on the effects of boric acid which he had given for the treatment of certain diseases, and that he had noticed that a certain number of the patients taking it presented sysmptoms such as I have described to you. From the correspondence of those symptoms with the symptoms of my own patient, and from the fact that a similar disease had occurred twice coincidentally with taking the boric acid, I came to the conclusion that this was in all probability a case of boric acid poisoning.

1425. Do I understand you that he was getting at the rate of 30 grains a day?—Yes.

1426. Do you consider that his system was equal to getting rid of that within twenty-four hours?—I do not.

1427. Then the effect of the doses were cumulative?—They were probably cumulative in that case. The reason why I consider that his system was probably not able to get rid of it was that the kidneys were diseased in that particular case. Dr. Féré has noticed that his most severe cases at Salpêtrière came on in patients whose kidneys were affected. I stopped the boric acid in this case, and under very simple treatment the patient absolutely recovered. He gained flesh, his hair came on again, and the skin became normal. Six months afterwards the original disease again became very troublesome; the boric acid had always given him so much relief that he again took the boric acid in spite of the symptoms which I had already told him had been produced by it. The same symptoms again came on, but to a very much less degree, because the patient being warned stopped taking the drug as soon as he commenced to feel any bad effects, such as the skin beginning to get red, painful, scaly, or anything of that kind.

1428. Have your observations led you to form any opinion as to the safety of boracic acid as a preservative in food?—I have formed an opinion upon the matter.

1429. Would you state it?—My opinion is this: From the result of my personal observations small quantities of boric acid might be added to milk without danger to healthy persons. I take milk because that is really the chief thing which has interested me, owing to the giving of milk to patients as an invalid dietary. I should say that by small quantities I certainly mean not more than one in a thousand, which is sufficient, I believe, to preserve milk from any apparent change for, say, from between twenty-four to forty-eight hours. The effect of boric acid upon milk is proportional to the quantity, and in order to preserve decomposable materials for twenty-four hours a much less quantity is required than is needed to preserve them for forty-eight hours, or for three days, or for four days. A small quantity may be added sufficient to preserve, say, milk—simply to take it as a type—for twenty-four hours or forty-eight hours, but would not be sufficient to preserve it for a longer period. I believe, from experiments I have made myself, and from observations of friends, who have used it, that a quantity of about sixty to seventy grains per gallon, which is one in a thousand, will preserve milk sufficiently for twenty-four or forty-eight hours, excepting, perhaps, in the very hottest weather. I do not think from the result of the observations I have made, that any healthy person would be likely to be harmed by this quantity of boric acid. The quantity they would get per day would be practically less than 10 grains, judging, say, about a pint of milk to be taken. But in cases where people were on an entirely milk diet—for instance, babies brought up by hand, or patients suffering from disease of the kidneys, where an exclusive milk diet is not at all unusual—those people might, I think, be injured by even this small quantity of boric acid.

1430. What quantity of milk would you say, roughly, a child of three months old would consume?—One to two pints, probably, at three months old.

Dr. R. B. Wild.

20 Nov. 1899.

1431. A quart?—Yes, up to about a quart, I should say; and an adult patient on a milk diet would take about two quarts, roughly speaking, of course, for the conditions vary very much indeed.

1432. But that would be an ordinary person?—A child up to twelve months old might take up to a quart diluted, and a child soon after birth would take perhaps half a pint to a pint.

1433. Then supposing there were one part in a thousand of boracic acid, that child would be consuming how much?—About nine grains in the pint.

1434. Eighteen grains in a quart?—Yes, and in proportion to the ordinary dose of medicines that one would give to a baby that would really be a very large dose.

1435. And possibly more than its kidneys would be able to deal with?—Possibly, but the kidneys in children are very active organs, and I think that the danger in very young children would probably, if it was continued for any length of time, be more that of loss of appetite and general loss of nutrition rather than kidney disease.

1436. Then that points in the interests of the public to some indication being given of the presence of the preservative?—I think it is very important. I assure you it is very difficult sometimes in treating cases to make sure in the case of an infant whom one finds suffering from a skin eruption, that that child shall be fed upon milk which you know contains no boric acid. One has to get a sample of the milk that is being consumed, and practically test it for one's self.

1437. I suppose in Manchester, as in other large towns, there are milk vendors prepared to meet every requisite on the part of the public, and of the medical profession especially?—Yes, there are.

1438. That is to say, they will supply pasteurised milk?—Yes. We have one or two firms who will do that, and they will guarantee it free from any preservative.

1439. That is an increasing practice, is it not?—I think, perhaps, it is. One company has not been started in Manchester very long, but I doubt if they will reach the poorest people, or the class of patients whom we get in the hospital.

1440. Is certified milk sold at a higher price than ordinary milk?—There is a little difference in the price; at least there is with one of our firms in Manchester; but whether that is a permanency, or simply a temporary arrangement, I cannot say. One feels from a medical point of view in this way, that the value of milk to poor children, in large towns especially, as a food, is so great that any regulation which would increase the cost of milk so as to make the ordinary children in large towns get less milk would be a serious matter. One would prefer them to have milk with a little boric acid, rather than no milk at all. That is the way I look at it.

1441. The price will be increased by the prohibition of the use of preservatives?—I feel in this way—that in the large towns milk has to be collected from many districts, and brought into the town, which necessitates a number of hours elapsing between the milk being produced and reaching the consumer. In summer especially a very large amount of milk would necessarily be soured unless it was preserved in some way during the transit, and that milk, even preserved in this way, is, I believe, preferable to no milk at all as diet for children, and is certainly preferable to sour milk, which is responsible, I have no doubt, for a considerable number of the digestive disorders which occur in so many children in hot weather.

1442. Have you made many analyses of milk samples?—I have not made very many. I have been interested more in the medicinal use of the acid rather than in the dietetic use. I have found traces of it in milk.

1443. What is the highest proportion?—Personally I have not found more than one in a thousand in the samples that I have examined. I cannot say that I have examined many samples, and the milk that I did examine, with even one in a thousand in, was certainly what I should call a good milk.

1444. Then, on the whole, I understand that you would advocate the moderate use, say, not exceeding one in a thousand parts of boracic acid rather than prohibit the use of preservatives altogether?—So long as some indication was given that the article of food containing boracic acid did contain it, I think that is a very important point.

1445. In the matter of milk, how could you give that

Dr. R. B. Wild.

20 Nov. 1899.

indication, milk being an article that is taken from door to door, and sold in open vessels?—It should be sold as preserved milk, that is all I can say.

1446. Then it would be a verbal guarantee?—It would be a verbal guarantee only, but I presume that if it was sold as pure milk, and was found to contain boric acid, there would be a certain risk of a penalty being attached to it.

1447. (*Dr. Bulstrode.*) What do you consider to be the contra-indications for the administration of boric acid?—I have a little difficulty in saying. Kidney disease, with albuminuria, I certainly think is one. I have seen albuminuria—that is, albuminuria of a temporary character—come on in one patient while taking boracic acid, and disappear when boracic acid was stopped. I have also seen patients with albuminuria in which the amount of albumen has been increased while they were taking the acid, and has again returned to its usual amount when the boracic acid was stopped. So that I consider that kidney disease is certainly a contra-indication of boracic acid. I should not care to take it myself if I had any kidney lesions, and I am rather of opinion that the cases in which the skin eruption comes out are more cases in which the drug is not fully excreted by the kidneys than cases where the kidneys are normal.

1448. Then you would not prescribe the drug to the extent of, we will say, even fifteen grains a day to a patient whose urine you found to contain albumen?—I should not do so if I believed the albumen to be due to kidney disease, but if I could satisfy myself by microscopy or otherwise that the albumen was from urethritis or cystitis, I should have no hesitation in giving ten grains three times a day—I do not often go beyond that.

1449. Provided you were fairly convinced that the patient was suffering from kidney disease you would not care to prescribe even small doses of boracic acid?—I should not.

1450. You would say that of course there must be an enormous number of the population who have some form of kidney disease?—Yes, certainly there is a considerable number.

1451. There are somewhere about 12,000 dying annually from kidney disease, and that would represent a very large number of persons who are going about with kidney disease?—Yes.

1452. To whom boracic acid would be contra-indicated?—In my opinion it would.

1453. Would you consider that in itself a considerable reason for prohibiting the use of boracic acid in milk?—I would not say to prohibit it; I would say to indicate that the milk contained it.

1454. Would you consider it sufficient to say that the milk contained a preservative; would you not rather consider it necessary, looking at this one point alone, to state that the milk contained boracic acid?—Yes, I think that would be necessary in the case which you are putting.

1455. Is it your view that provided the fact that the milk contained boracic acid was stated an enormous number of poor people about the country in our great towns would still be unaware that boracic acid was bad for kidney diseases?—Yes, but I presume that in a case of that kind the medical attendant of those people suffering from kidney disease would in all probability give as part of his dietetic directions, which are, of course, very important in kidney disease, the fact that they must not take milk containing boracic acid, just as he would prohibit excess of animal food or any other such thing. That is what I should look upon as their protection.

1456. Of course I can only ask this in general terms, but would you not consider that there is a very large number of people going about with kidney disease a long time before they consider it necesary to take medical advice?—Yes.

1457. Then those people would be still taking a milk containing something which is contra-indicated to their condition?—Yes, they would, but not in large quantities.

1458. Would the consideration of that lead you to modify your opinion at all as regards the labelling of the milk?—Of course, the difficulty is at both ends, as it were—that in the one case there is the value of the milk for children, which is what I was looking at mostly, and in the other case there is the injuriousness of the milk to people who are already diseased; and there is a balance of opinion there on which it is difficult to decide. Personally, I must confess that I think the benefit to the children of getting milk at all is greater than the injury to a certain number of people who are already diseased, especially as the latter would not be likely to be on a milk diet.

1459. Then we may take it from you that you consider that a diseased condition of the kidney contra-indicates the administration of even small doses of boracic acid?—I have never seen bad effects come from 5 grain doses at all in any case.

1460. With adults?—With adults, I have never seen bad effects, nor have I observed any bad effects in myself from 5 grain doses of boracic acid. The smallest dose from which I have seen any bad effects has been the 10 grain dose. I have given a 5 grain dose and I have taken a 5 grain dose, and that 5 grains did not cause any effect.

1461. Altogether, in how many cases have you seen a bad effect from administering the 10 grain doses of boracic acid?—In about 6 or 7 cases.

1462. Out of about how many?—Out of over 40; but there are some of those cases I must mention which were simply cases in which a little nausea, loss of appetite, and sickness were produced—not cases in which there were any kidney lesions. I have only seen three cases in which albuminuria was produced or increased, and in one of those cases the dose was 20 grains.

1463. Suppose it were put before you in this light, that it was true that there were some people to whom boracic acid did harm; would you say that the view that those people are idiosyncratic would cover the position?—I would not like to give my opinion in that way. As I have already expressed in a paper I read some time ago we have not sufficient evidence to say whether it is idiosyncrasy on the part of the patient or pre-existing kidney disease which determines the fact that toxic symptoms will occur.

1464. It is a very difficult point, and wants to be cleared up?—I should certainly say that if it was simply idiosyncrasy affecting only a small number of the population that is a thing that may be perhaps neglected, but if it is a peculiarity affecting a large proportion of the people, then it becomes hardly right to call it idiosyncrasy, I think.

1465. That is what I am anxious to get at?—Then it is a normal condition.

1466. You do not regard the reaction of the human species towards boracic acid as one to which the term idiosyncrasy is applicable?—No, I think that it is a matter of dose.

1467. What other conditions would you regard as contra-indicating the use of boracic acid?—I should regard certain conditions of the stomach as probably contra-indicating the use of boracic acid; that is, especially in children perhaps—cases of want of digestive power.

1468. In children?—Yes, atonic dyspepsia.

1469. Would you say that was a widely prevalent disorder in a place, for instance, like Manchester?—Yes, it is fairly widely spread.

1470. Then that is another fairly widely spread condition which would contra-indicate the administration in your opinion of boracic acid?—It is a case in which I think the administration of boracic acid would be likely to do harm.

1471. And you would not yourself give it?—I should certainly not give it.

1472. Any other conditions?—I do not know of any other.

1473. Did you ever hear of the reported action of boracic acid upon the muscular tissue of the uterus?—Yes, I have heard of that with borax.

1474. Would you consider the fact that this drug is reported by high authorities to produce a contractile effect upon this tissue to be a contra-indication to the use of the drug in certain conditions?—I should not, because of the quantity. I do not think anyone could take the amount necessary to produce the effect upon the uterus in the ordinary way of food.

1475. Do you know what Dr. Lauder Brunton said on that point?—I have read it, but I am not quite familiar with it. I am not able to say that I remember it perfectly.

1476. You do know that it is thought that boracic acid may have some effect upon the uterus?—I know that borax has, which, of course, is practically the same thing physiologically, but I was not aware that boracic acid itself has been used in that way. Borax is reputed to have that effect.

1477. It is stated in some books on therapeutics that it should be either avoided or used with great caution in pregnancy?—Yes, I know it is so stated, but I have had no personal experience of borax being given in pregnancy.

1478. Are there any other conditions which you would regard as contra-indicating the use of boracic acid?—From my own observation no. I have given you, I think, the two conditions.

1479. Have you made a study of the question of autumnal diarrhœa?—I cannot say that I have.

1480. Have you any reason to suspect or any reason to disbelieve that the autumnal diarrhœa may possibly be kept up by the use of boracic acid at a time when the weather is hot, and when a large amount of boracic acid is used?—I have no reason to suspect it. I do not know that I am in order in mentioning certain observations that have been told to me by my own friends knowing that I was interested in the question. I can only say this, that a friend of mine, who was talking over the subject with me, and who has the charge of an institution in which there are a considerable number of people, has systematically administered boric acid in the milk for the purpose of preserving it during the summer and autumn for some years past, and he takes care that only a small amount is used, one drachm, I think, to the gallon is the amount, which is $7\frac{1}{2}$ grains to the pint, and he says diarrhœa has diminished in the children since he began to use it. He believes that sour milk, or milk slightly sour, produces diarrhœa more readily than milk containing boric acid. That is purely a statement made to me, and is not one that I can substantiate in any way.

1481. Do you think it is at all likely that the use of boric acid leads in our large towns to the sale of milk which, save for the boric acid, would not be accepted by the public—to make it clearer, I will say partially decomposed milk—milk which is just turning—which would be refused but for the boric acid which is added to it?—I I think it is quite possible. I believe that the boric acid will limit the action of the lactic acid fermentation, but will not necessarily limit, say, decomposing changes in the proteids of the milk. I do not know anything more about that, but I can quite conceive the possibility.

1482. Then it is possible that children taking boracised milk in the summer may be taking with it ptomaines and boracic acid?—It is possible.

1483. Would you go further than that; would you say it is likely?—I would say I have no information about it at all.

1484. Do you know that more boric acid is added in summer than in winter?—I believe that is the case—that is to say, I am informed that some milk vendors use it in summer, but never use it in winter, when the weather is cold.

1485. Have you any information to give to the Committee with regard to the other preservatives, such as salicylic acid and formalin?—No, I have no information about those preservatives.

1486. Have you any information on the subject of copper in peas to put before the Committee?—No, I have not.

1487. Have you any information with reference to colouring matters?—I have nothing which I have specially worked at. My interest in the question of boric acid, of course, is purely a professional interest, and I have not taken the subject of food preservatives as a whole.

Dr. R. B. Wild.

20 Nov. 1899.

1488. After the points we have discussed together, would you still be satisfied with simply stating that "this milk"—I forget exactly what is the term used?—"This milk is preserved with borax," or "boracic acid," or something to that effect.

1489. You think it is necessary to state that?—I think so, after what you have said as to the use of preservatives in milk, and diseases of the kidneys.

1490. You think that if it were stated that the milk is preserved with formalin or boracic acid that that would be sufficient for the present?—I do not know as to what the effect of formalin in milk is; I have no information upon that at all.

1491. At any rate, "containing boric acid"?—Yes, preferably, but if it was simply that the milk was preserved with some preservative that would be enough from my point of view.

1492. With some preservative?—It has to be proved that formalin, for instance, may not be taken safely.

1493. Would you advocate, or not, that the name of the preservative should be given, that is what I mean?—I should prefer it as a matter of accuracy. I can quite understand that practical difficulties might arise, and one would prefer to have the label simply "preserved" than not to have the milk labelled at all. The ideal of course, is that pure milk should be used without any preservative by everyone, but one recognises that although that is one's ideal it may, perhaps, be unattainable owing to the difficulties of collecting and preserving milk. The next possible thing is that milk should be labelled as to what it does contain. If that is impossible, then it is better that it should be labelled to contain something which may be deleterious. That is the order in which I should put it.

1494. (*Chairman.*) When you speak of labelling the milk, are you not undertaking a problem of great difficulty? Every tumbler of milk that is sold in a railway refreshment bar would have to be labelled?—I can see the practical difficulties very easily, but I think for the safety of the public, especially of those who have to take a milk diet, it is desirable, if possible, that the milkman who sells it, if he sells milk containing boric acid, should state that he does so—perhaps in some conspicuous place on his milk cart.

1495. An ordinary railway passenger would not notice that; it would not be brought under the notice of an ordinary traveller by railway?—Would it not in this way? Supposing the railway passenger had been warned previously that he was not to take milk preserved by boric acid, it is possible that he might look out for such a notice rather more carefully when getting milk. That is the only point that I would make.

1496. (*Dr. Bulstrode.*) Would you care to give boracised milk to a patient with typhoid fever?—I think if there was only a small quantity of boric acid in the milk it would probably not be injurious.

1497. Would you give it to a patient with scarlet fever?—I would rather not, because of the danger of setting up any irritation of the kidneys; I would not give it if other was obtainable; I would put it in that way.

1498. You would not go so far as to say that in hospitals such as that of the Metropolitan Asylums Board, where acute cases of scarlet fever are taken in, the use of boracised milk should be as a general principle prohibited?—For all cases? Yes, if it is to be used for all cases I think so, certainly. I think the danger of giving boracised milk to cases with severe kidney lesions in scarlet fever would be great.

SIXTH DAY.

Tuesday, 21st November, 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary.*

Mr. THOMAS CLEMENT, called; and Examined.

Mr. T. Clement.

Nov. 1899.

1499. (*Chairman.*) Are you a managing director of Messrs. A. Clement and Sons, Limited, of Glasgow, Manchester, and London?—I am one of the managing directors.

1500. I understand that you represent here the Scottish Wholesale Provision Merchants' Association?—Yes, I do.

1501. You have had considerable experience in the provision trade, I believe?—Yes, for the last fifteen years I have been engaged in it.

1502. Are there any special substances on which you wish to give evidence? I may tell you that we have had a great deal of evidence on the ham and bacon trade, and the butter trade, as to the preference on the part of the public for mild-cured goods and the consequent use of certain preservatives; therefore I do not suppose I need take you through that part of the evidence as we are pretty well seized with it already?—I have been asked by the Executive of our Association to give evidence on the dairy produce section of the trade, and to express their views on the use of preservatives and colouring matters in dairy produce.

1503. Will you be good enough to state those views?—Our Association are of opinion that the use of preservatives in certain proportions is absolutely necessary for the carrying on of the trade in butter. This is especially so in connection with Colonial butter—that is, Australian and New Zealand butter, which is now well known in the market.

1504. Do you include "Canadian" in the term "Colonial"?—No, I do not.

1505. Why not?—I intended to speak of Canadian butter separately.

1506. Then you indicate Australasian butter by "Colonial butter"?—Yes. I speak of Australasian butter just now. In the trade we speak of Australasian butter as "Colonial butter," and we speak of Canadian butter as "Canadian butter." I may say our firm are the agents for the Agricultural Department of the Canadian Government in this country. We issue reports to them on the condition of the trade and generally advise them as to any changes that are taking place, and give them advice as to how to send their goods here to meet the public demands. We have strongly advised the Canadian Government to issue recommendations to the factory men to use boracic acid as a preservative in their butter.

1507. At present that is prohibited, is it not?—I do not know that it is prohibited altogether, but it is not universally used.

1508. Do you handle large quantities of Canadian butter?—Yes, very large quantities.

1509. Do you find that there is a greater difficulty in dealing with it than with Australian butter?—Yes, on that account.

1510. For obvious reasons?—Our difficulty with Canadian butter is this—that after coming from the refrigerator it does not stand the counter, or the keeping in the house, as well as the Colonial butter which has a small percentage of boracic acid. We handle considerable quantities of Irish butter, and I have to report that the quality of Irish butter has improved very considerably in recent years. If it had less moisture it would be the first butter on the market—it would be superior to Danish. We handle Danish butter, but in our opinion the quality of Danish butter has deteriorated in recent years.

1511. In what respect?—Particularly in flavour and texture.

1512. It is very dry, is it not?—The Danes have a drier butter than in Ireland and that gives them the advantage; but they have not got the flavour of the finest Irish. The unfortunate thing is that we get so little of the very choicest of the Irish that excels the Danish; but Danish butter has deteriorated in recent years.

1513. Does it command the same price in this country?—Yes, it commands the highest price because the trade in Danish butter is more systematised in distribution than that of any other butter.

1514. No preservative is used in Danish butter, I believe?—I believe not; it is claimed that no preservative is used in it.

1515. A witness before us the other day spoke of Argentine butter as very fine; have you had any experience of that?—We handle Argentine butter; some is fine and some is not.

1516. Does that contain preservatives?—As far as I know it does contain preservatives. The Danish butter has lost its keeping qualities—that is, it is not stored now the same as it used to be, because people find that it goes stale and will not keep.

1517. Can you account for that in any way?—I think they have given up using preservatives and gone into Pasteurising as a prevention against butter going strong. It alters the character of the butter entirely, and while it keeps it a little longer at the time, it does not make it a keeping butter. To make it clear I would explain it in this way: Say you had a butter that would go off in three days, by Pasteurising you might make it keep for ten days, but then it would not be a butter that you would want to hold for three or four months. Until recent years it was a common practice to store large quantities of Danish butter for winter use, but no one would think of doing that now.

1518. Have you formed any opinion as to the percentage of boracic acid necessary for the preservation of butter?—My opinion is that one per cent. of preservatives, which I understand means about a half per cent. of boracic acid, is ample for keeping butter. Any excess over that quantity would show in flavour and would deteriorate the quality of the butter.

1519. Do you think you could detect the presence of a higher proportion by the nose or the palate?—The boracic acid flavour in butter is a distinct flavour—distinct entirely from rancidity or any tendency to rancidity. It has a flavour which we in the trade detect at once and say, "That contains too much boracic acid." It has a distinct flavour, a musty flavour, which is objectionable and lessens the value of it.

1520. Your opinion is, then, that the prohibition of boracic acid and other preservatives would interfere very seriously with your trade?—Yes. We believe that people would not go back to the butter they used twenty years ago—the heavily salted butter that was both too salt for the palate and to a certain extent rancid. They would now use margarine in preference to such butter. Besides I believe that there is less danger in their using mild butter with a small percentage of boracic acid than a heavily salted butter in which decomposition has started.

1521. Do you deal with margarine?—Yes.

1522. I suppose the preservative is used in that also?—In some cases.

1523. Have you any knowledge of cases where it is not used?—Yes. We do not use it in winter. It is only used in summer.

1524. When you say, "We do not use it," what do you mean; you do not make margarine?—We are largely interested in the United Creameries.

1525. And in the creameries do you say the preservative is only added to margarine in summer?—For about two months in summer.

1526. Is it added to the butter also?—No, not for fresh butter, because that butter is all consumed within two days.

1527. (*Professor Thorpe.*) Do you say that all the butter from the Australasian Colonies is preserved with boracic acid?—I have no experience of any butter coming from there that does not contain a percentage of boracic acid.

1528. Even New Zealand butter invariably contains it, according to your experience?—Yes.

1529. Have you any knowledge of the composition of the preservatives which are actually employed?—I have no analyses of them. I believe they are mostly composed of borax and boracic acid.

1530. What is the precise ground for the statement that the amount of boracic acid in a butter containing 1 per cent. of preservative, only represents a half per cent. of boracic acid?—I answer that question from the information given to those in the industry by the manufacturers of those preservatives, who guarantee that 1 per cent. of their preservatives does not contain more than one-half per cent. of pure boracic acid. The addition of 1 per cent. to butter in manufacture would not mean that the butter contained a full half per cent.

1531. Would you be surprised to learn that eight-tenths of the preservative consists of boracic acid?—I would be very much surprised to learn that.

1532. (*Dr. Bulstrode.*) What is the practice which you adopt for ascertaining the presence, or absence, of boracic acid in butters imported from various parts of the world?—By taste. Any butter that contains an excess of boracic acid we detect it on the palate.

1533. What is the smallest percentage of boracic acid which you think you can detect by the sense of taste?—It is difficult to say exactly. We do not complain of any butters that contain half per cent. In the case of anything above that we would complain to the shippers on the other side that their butter contained too much boracic acid.

1534. But, as I understand you, your only method of testing whether or not the butter supplied to you contains preservatives of one or another kind is by tasting it?—Yes.

1535. Suppose the butter contained 0.25 per cent. of preservative, do you think that you would detect it then?—No; I do not think you could detect it. You could detect it if the butter was not keeping.

1536. Are we to take it that in all the butters supplied from the Colonies that you have to do with, there is at least 0·5 per cent?—In Australian butter I should say that about 0·5 per cent. would be the average.

1537. To put it in another way, in all the Australian and New Zealand butter with which you have to do, you are able to detect the presence of boracic acid; is that so?—No.

1538. How do you know it contains boracic acid?—We know that it contains boracic acid.

1539. What I want to get at is as to how you determine it?—Only from our knowledge of the trade, and knowing that boracic acid is used there in the factories, and that it is necessary. We recognise it as a necessity. If butter comes over here stale in flavour we very frequently write and tell the shippers on the other side that the preservatives must be at fault, because the butter has arrived in poor condition.

1540. You say in all cases of the addition of, we will say, more than 1 per cent. of boracic acid to butter you are able to detect that there is too much boracic acid?—Yes; such a quantity would depreciate the value of the butter.

1541. Do you think that if the butter were partially decomposed you would still be able to detect the boracic acid?—No, I do not think so.

1542. You do not think you would?—I do not think so; I do not think you could detect the boracic acid, because the rancid flavour would be the most pronounced one.

1543. You do not think it would be possible to add so much boracic acid as to veil the effects of rancidity?—No.

1544. (*Dr. Tunnicliffe.*) How long, do you think, it necessary for the purposes of trade that butter should keep after its arrival in this country?—I would fix no limit to that. We have experiences sometimes of a vessel breaking down, and taking three, and four, and five months on a voyage, and then of the butter coming in here at a season of the year when it is not required, and when it may be necessary to hold it for some length of time. As a rule all the butter is consumed within four weeks of leaving the refrigerator.

1545. That is to say of leaving the ship in the case of imported butter?—Yes.

1546. You said just now that butter arrived at a time of the year when it was not required; from that do we infer that you occasionally hold over butter for some considerable time?—Yes. The Colonial shipments come in here in the winter, and when taken from the refrigerator they do not go off as quickly as they would do in the summer. Butter that has once been in a refrigerator has not the keeping properties after it is thawed, of butter that has never been refrigerated.

1547. Even although a preservative has been added?—Even although a preservative has been added; and it is dangerous to take butter that has been stored in a refrigerator, and then keep it for any length of time in warm weather.

1548. You say it is dangerous?—Yes.

1549. Do you mean that the butter becomes rancid?—Yes, it becomes uneatable. Consequently there is not the demand for butter out of cold store during the summer months, and the trade depend on local supplies. That is especially so in country districts, where a small grocer, who cuts a box of butter in a week or two weeks——

1550. What do you mean by "cuts a box"?—That is, he retails it out of his shop, and one box of butter may last him for a week, ten days, or two weeks; that man dare not use butter out of cold store for that length of time in summer.

1551. You mean to say then that the butter got fresh from the neighbourhood—I use the word "neighbourhood" in its large sense, of course—will keep longer than butter with a preservative added to it, that has been removed from cold storage?—If the butter is of equal quality.

1552. (*Chairman.*) I should like to get correctly on the notes what you have to say about your recommendations to—the Canadian Government, was it?—To the Dairy Commissioner. The Canadian Government have the industry under the charge, if I may express it in that way, of a Dairy Commissioner, and he takes an interest in all that is of service to the industry, and makes experimental shipments to this side of all kinds of butter.

1553. What body was it that forwarded the recommendation—was it your private firm, or was it the Association of Merchants?—It was our firm as agents.

1554. Would your trade have any objection to distinguishing by label or otherwise, butter containing preservatives from pure butter?—I do not see that there would be any objection beyond that of the trouble and annoyance of having samples taken, and of being uncertain whether they were protected. I do not think it would cause any prejudice against the goods, and I believe that the public would take them just as well, although so marked. All those restrictions on trade that hamper trade are naturally objectionable to the retailer.

1555. Yes, but the interest of the consumer has also to be considered, has it not?—Yes. I am speaking on behalf of the trade.

1556. In the old days of heavily salted butters it would have been fraudulent to attempt to sell a salted butter as fresh butter, would it not; you could not have done it, in fact?—No; there was too big a difference between salt and fresh.

1557. Now that you have substituted a mild preserved butter for the old method of salting, would it be unreasonable to ask that the same distinction between preserved butter and fresh butter should be maintained?—If it can be carried out without too much harassment to the retailer, or risk to the retailer, I do not see any objection to it. It is only one more hindrance to his trade. But I do not think that such is necessary.

1558. Why not?—Because really when a customer buys a butter he wants to get value for his money (and to get the best article he can for the money). I do not think the public care whether the butter was made yesterday, or whether it was made two months ago; they would cer-

Mr. T. Clement.

21 Nov. 1899.

tainly prefer a butter that was made two months ago, if it was better than the butter made yesterday.

1559. But assuming that the evidence which has been laid before us is correct, namely, that in certain conditions of health boracic acid is injurious to the human subject, would you not rather put the interest of the consumer before that of the retailer in such a case?—Certainly. I cannot speak from the scientific side of the question, but my experience of the taste of the public is this—that they want to get the best article they can afford to buy, and that they are not very particular where it comes from or what it contains, provided they believe it to be wholesome, and it is palatable.

1560. (*Professor Thorpe.*) I think the point the chairman has raised is one of, in fact, a good deal of importance. Supposing that a customer were to come into a shop, and ask for "fresh butter," might he have sold to him, and in good faith, a butter which has been preserved in this manner?—The public speak of "unsalted butter" as "fresh butter," and if they ask for "fresh-made butter," and get "stored butter," then I would think—well, it might not be to the prejudice of the consumer, still he had not been supplied with what he asked for.

1561. That is the point; a man comes in, he does not ask for "fresh-made butter," that is not the term commonly used, he asks for "fresh butter," a term that has already got a distinctive significance to every consumer of butter. "Fresh butter" is used in contradistinction to "salted butter"?—Yes.

1562. The man in the street knows little about preservatives, you see; to him a "fresh butter" is an unsalted butter, but it is a fresh butter, which has a certain enhanced value in his mind?—Not necessarily.

1563. Why not?—Because he asks for an unsalted butter, but instead of asking for unsalted he asks for a "fresh butter."

1564. Meaning what?—Meaning unsalted butter.

1565. No; he means a butter which has been freshly made surely—a new butter?—I do not look on it that way.

1566. Do you not think he does?—No. I am speaking more from the trade custom in the North, and there all unsalted butter is called "fresh butter," and all butters containing salt are called either "powdered" or "salt butter."

1567. Why is it called "fresh butter"?—Because it is unsalted.

1568. No?—I grant you that in the past unsalted butter was supposed to be fresh.

1569. Quite so, and the man is just buying it under the supposition that it is fresh?—Fresh made.

1570. Yes.—He may be.

1571. He connotes the same thing that he always did?—He may be, if he does not know the source of supply, but if you have a ticket up "New Zealand Fresh Butter," he must know that that butter was not made within the last few days.

1572. But it is not invariably that such tickets are exposed. A man goes and asks for "fresh butter"; he may be sold a produce of this kind many months old, and only kept in an unsalted condition by the use of preservatives?—That is so.

1573. Now the point is this, is not that consumer, in so far as he does not get something of the nature and quality of the substance demanded, prejudiced under the operation of the Foods and Drugs Act?—He might be legally.

1574. That is all, if he is legally?—I do not see that he is prejudiced a bit if he gets an equally good article or a better article than fresh made, but if he saw butter marked "New Zealand Fresh Butter" he would easily understand that that was not fresh butter—it could not be.

1575. (*Chairman.*) Why not mark it "New Zealand preserved butter" at once?—Then you would have to put it "New Zealand Unsalted Butter," and the buyer does not speak of unsalted butter; I never heard the term used in the North.

1576. No, but you have said there are difficulties with the retailer, and all that; he puts up the words "New Zealand Fresh Butter"; why should he not put up the words "New Zealand Preserved Butter," and state the exact case?—You mean that he would require to educate the public. That is the most expensive thing that any retailer can do. As a rule the successful retailer is the man who supplies the public with what they want and ask for.

1577. Yes; but think, Mr. Clement, what you are saying; the implication from the evidence, if it goes out, will be that you, a wholesale dealer, think it advisable to delude the public into the belief that they are buying fresh butter, which they would not buy if they knew it to be preserved butter?—Not at all.

1578. I do not mean to say that that is your meaning, but that will be the construction surely?—I do not mean that at all.

1579. No, I am sure you do not?—I hold that a man is entitled to get exactly what he asks for.

1580. He asked for "fresh butter," and you give him preserved butter?—No, if he asked for fresh-made butter——

1581. That is the difference between a fresh egg and a fresh-laid egg; how many people could define the difference between the two?—I was speaking more of trade terms when I say a fresh butter is an unsalted butter.

1582. (*Professor Thorpe.*) But you have taken over the term, and you have used the term in a sense which it originally had not; a fresh butter meant a butter with a minimum quantity of salt, and nothing of the nature of a preservative in it?—I speak of it as a trade term or custom as it exists at the present time; whether it is advisable to make a change or not depends on circumstances. If it is decided that such a change is necessary I have no doubt the trade would soon accustom itself to the new term.

1583. (*Chairman.*) You are here representing the trade, and I am quite sure that it is not the intention of the trade to impose upon their retail customers in any way?—No; the best interests of the trade are to supply the customers with exactly what they want, or what they think they are buying.

Mr. W. Davidson.

Mr. William Davidson, called; and Examined.

1584. (*Chairman.*) You are the senior partner of Messrs. John Laird and Co., I believe, importers and wholesale provision merchants, of Glasgow?—Yes.

1585. You have heard what the last witness has said with regard principally to dairy produce?—Yes.

1586. Do you corroborate it from your experience?—Yes; generally I do. There are some little points of detail on which I may not, but nothing vital. To-day I am here more especially to represent the views of the Scottish Provision Trade Association on the question of the curing of meats and the sale of meats cured by preservatives. Locally there is no such thing as the use of preservatives in the curing of meats separate from salt, and a little saltpetre.

1587. By "locally" do you mean in Glasgow?—In Glasgow and all over Scotland, there is no such thing as the use of any other preservative than salt and saltpetre. But we handle very largely there imported meats from Canada and the United States, which are partially preserved by the use of borax.

1588. Not cured by the use of borax?—No, they are not cured with borax. They are very mildly cured with salt, and a little saltpetre, and then they are dried, and a little borax sprinkled outside to arrest the cure practically, and to arrest also decay; that is to keep them in this semi-cured condition until they are into consumption. That custom in the trade has developed the use of those meats enormously in our district, because the large proportion of the consumers where these meats are most largely used are in such districts as Coatbridge and Motherwell, and around those districts where there are large iron works, and thousands of iron workers, working in a hot, dry atmosphere, where they could not possibly use these meats if preserved in the old form—that is, if salted as they used to come into use. Therefore, if this was interfered with it would be a very serious matter for these thousands of workers, and also the workers in our local factories and mills; working as they do in these hot rooms, and a dry atmosphere, they could not use with impunity the salted meats that prevailed in the trade twenty-five or thirty years ago; therefore we consider it a necessity that this custom that presently prevails should be allowed. As a matter of fact, this borax which is

Mr. W. Davidson.

21 Nov. 1899.

sprinkled on the exterior of the hams, and on the exterior of the bacon, whenever it comes in to us we have it at once washed off in pretty hot weather; we wash off almost every stain of it that is there. Then that meat is prepared, and sent out to the retailer in this mild condition. It is not the custom in Scotland for the retailer to carry stocks of these meats for any length of time, because he recognises that they are mild, and it is prevailingly the custom now that retailers buy from week to week. Therefore I may say that the bulk of our importations into the Clyde are into the hands of the consumers within a week of their arrival. There, again, they are into consumption within a week of the retailer getting them. That is the custom right over the west of Scotland. There are some parts of the Border Counties where they work on the old principle of carrying stocks and hanging hams up to dry like a York ham. A ham that has had borax applied to it is not suitable for that kind of thing, because when hanging up the borax would permeate the meat. As we send the hams out the borax has really not in any sense at all permeated the meat. If I was buying stuff at the wharf, for instance, I would take a thing not unlike this needle here (*pointing to a stationer's bodkin*), and go in just under the skin, but about the top of the ham, within a quarter of an inch in, and test it by the smell for the appearance of borax in the meat, and if I found it there then I should not use that as a fine ham.

1589. You have heard that borax does penetrate the fat and the muscle?—If the ham has been badly handled on the other side; take it that the hams have not been thoroughly dried, do you understand, and this boracic acid has been put on, then the borax gets moist, and "silts" into the ham a little, and in the course of transit it does affect the flavour to some extent. That disqualifies the ham as a first-class ham. We expect to get our best goods entirely free from any trace of borax in the meat, even a quarter of an inch in; otherwise we would reject it as not being fine goods.

1590. Have you ever made any experiments with meat from the interior of a ham to see how far the borax has penetrated into it?—We have been offered meats in the case of which the borax has gone quite an inch into the meat. Those would be hams that have been rejected for some cause, and have lain possibly in store, not meeting with a free market.

1591. What becomes of those hams ultimately?—Some of them go to the oil refiners. If the flavour of a ham was so touched with the flavour of the borax, people would not care to eat it.

1592. They are none of them disposed of to low-class traders?—Not much, because the packers are careful. It means that it is a great loss to them. They do not do that kind of thing willingly or intentionally, and it is only when some bit of carelessness has been displayed that it happens. It is a serious loss to a packer when the like of that occurs, and it does not often happen. It is only in such a case as that where the borax perhaps was put on to the ham a little moist that it really gets in a bit. But if the ham got a quick, ready passage over, even in these circumstances we would get it in a condition in which we could remedy that by washing it off.

1593. Do you corroborate what the former witness has told us in his experience with foreign and Colonial butters?—Yes, so far as Australian and New Zealand butters are concerned, we expect that all of them have been to some extent cured by the application of preservatives.

1594. What do you say as regards Danish and Canadian butters?—The Danish butter, we are told, has no preservative. There is some of it that it is difficult for us to understand that there is no preservative in it; but, however, we have got to accept it that there is none.

1595. I do not see why you should accept it; have you any reason to believe that there is a preservative in it?—Yes, I have an idea that there must be in some of it.

1596. Have you ever submitted any of it to the analyst?—I am going to submit some of it to-morrow when I get back to Glasgow, and I will send you the result. I thought of wiring to-day for a sample of butter to hand over to Professor Thorpe, but I would rather have it done in Glasgow. I will have that done to-morrow, and we will send Mr. Huddart the result. I want to emphasise what Mr. Clement has said with regard to the want of keeping quality in Danish butter in these recent years, because, as he has pointed out to the Committee, it was a very large business, especially amongst Edinburgh, Leith, Newcastle, and Hull people, preparing for winter business in the summer time by keeping the Danish butter for their winter trade. It kept beautifully with a magnificent aroma. In the months of February and March you would find that butter opening up almost with the bloom as it came fresh from the dairy—perhaps butter that had been made on the grass. Now, that is not the case at all. You open up Danish butter—we might take it, butter coming to Glasgow and arriving on the Monday, has left Denmark on the Thursday, and it may have been made on the Tuesday; even when getting it on the Monday it has not the bouquet that Danish butter used to have. There is a negative quality about it now that Danish butter did not use to have. That we believe is through the treatment of the milk—the pasteurisation of the milk.

1597. (*Dr. Bulstrode.*) Would you tell the Committee your authority for the statement that the Australian butter is cured with preservative?—Because I know that with the percentage of salt that is in it it could not possibly keep as it does if there was only the limited percentage of salt that we find. It is easy to detect by the palate the amount of salt, or the near amount of salt, that is in the butter; and therefore knowing its keeping quality we are bound to believe there is something besides the salt there.

1598. Then these statements are purely inferential and you have no actual calculations on which you base them?—We are told that this is applied to all that butter; and we know from the keeping qualities of other butters that that butter could not keep as it does unless there was something besides the two or three per cent. of salt there is there.

1599. Why do you say that all experience is against the free use of salt foods in the atmospheric conditions in which the workers in factories and mills live; what is your basis for that statement?—Because we know that the people suffer from the use of salt foods in these places.

1600. In what way—would you specify?—I think the use of salt foods is detrimental to their stomachs; and then I think it leads them to drink more than they should. We know that because we hear men saying that they cannot take it, that they cannot eat salted ham, and that they cannot eat salted bacon and work in these places.

1601. What did they do before the introduction of boracised food?—They took less of that. There was very much less of bacon meat sold, and they probably ate more cheese. They did eat more cheese in such circumstances.

1602. Do you think a lot of cheese was better for them?—I think we must allow them to get what they want if they can pay for it. They are entitled to a change. It is pretty hard for a man now to have cheese from Monday to Friday.

1603. I only wanted your evidence for this statement?—That is so. It is based on hearsay from the individuals themselves—men who work in these places, and women working in these mills say that they would not eat the salt meat with any comfort to themselves.

1604. (*Dr. Tunnicliffe.*) You say that you test hams roughly by inserting some sharp instrument underneath the skin?—Yes.

1605. After you put the instrument it, what do you do—taste it?—No, smell it.

1606. By that means you can smell, you think, whether the borax has penetrated into the substance of the ham or whether it has not?—Yes, that is so.

1607. Have you by any chance ever been wrong?—No, it is hardly possible for an experienced man to make a mistake in that, because if the borax has got there you feel it quite perceptibly.

1608. Can you distinguish clearly between what you would smell at the end of this instrument, with regard to borax, and what you would smell with regard to taint?—Yes, they are quite different. Besides we would not catch a taint at the same place even; a taint would be in the interior of the ham.

1609. That is the interior of the ham where you test for borax?—It is the interior in the sense that it is not the exterior, but if I put it through within a quarter of an inch of the surface I would not reckon that the interior as I would putting it through the centre. If I wanted to catch taint I should go through the thicker part of the ham, right through the centre of it, alongside the bone, and there I would catch taint, if there was any, with the very same instrument. I would pierce in the one place for taint and in the other for borax.

1610. Then you attribute the penetration of the borax

Mr W. Davidson.

21 Nov. 1899.

into the substance of the ham not to borax being used in the curing——?—No, there is no such thing.

1611. But to the ham not being sufficiently dried?—Yes, and the borax therefore enters it.

1612. You are quite sure of that?—I am quite sure of it.

1613. Do you not think the fact that the people now eat a great deal more meat than they used to would perhaps explain the reason why they cannot take salt food so well as they used to—that is a fact, I mean to say, that people now eat meat three times a day who used to eat it only once?—That meat would be put out of competition altogether if it was salt, because they can get fresh beef and everything else fresh now. As a matter of fact, in our own curing of meats—and we cure many tons of meat every week—we keep it only a third of the time in the pickle, in the brine, that we did twenty years ago.

1614. Do you attribute the fact that Danish butter has not a fresh aroma to the fact that you think it contains preservatives?—No. I said I thought it was how the milk was dealt with that caused the butter not to have the bloom and bouquet it used to have. I did not attribute it to the use of preservatives.

1615. (*Professor Thorpe.*) The only question I wish to ask is with reference to the statement which you make that there are certain cuts of bacon stuff brought in cured in salt from Canada and the United States, but these are the most difficult to sell?—Yes, the coarser cuts and fatter meats.

1616. Therefore you say they are put in salt?—Yes.

1617. I do not quite understand the logic of that?—I have stated to the Committee already that, for long keeping, borax is a mistake. It would be a mistake to put borax on a York ham, for instance, that was to hang.

1618. I beg your pardon; it has to be hung, that is the reason?—Yes, the same thing applies there. To put borax into a ham for curing, as has been suggested, would spoil it, it would waste its flavour entirely. The very same thing applies therefore to these meats that have to be kept long, therefore they put them in salt instead.

1619. I quite understand it now; I did not gather that at first; the reason is that they may have to hang for a longer time?—Yes.

1620. The only other point I should like to ask is this: You say that your trade more particularly is a week to week trade?—Yes.

1621. And that your retailers take your produce and get rid of it practically within a week?—Yes.

1622. Would not that be equally applicable to butter; would not those same people work through their butter in the same way?—Yes, but there would be the difficulty of the distance with the butter.

1623. Assuming that it could be brought over, assuming that the mere transit did not require the necessity of the borax or the boracic acid, assuming that it would be a week to week trade, then the borax would not be required by the retailer?—The difficulty on the one hand is that in bacon stuffs we have a regular supply all the year round, and I can contract to-day up to June for weekly deliveries of all fresh fine goods that I want for my business. But I cannot do that with butter. We have got to take the butter, as it is made. The Australians have a season for their butter, and that season pases by, and it has got to come here during that season. Therefore there is that difference between the two commodities. The one is there and we can buy it just as we want it, fresh all the year round. There is no close season for the bacon trade; but there are close seasons for the butter trade, and therefore it must come when they have it. You cannot arrange the butter trade just in the same way as you can the bacon trade.

1624. Perhaps not altogether, but what I am really driving at is this, that as there is a very large proportion of butter which comes from Denmark, and which is unpreserved, one does not quite see why it might not be possible to reach a similar state of things with regard to butter in general?—Yes, but here you have the Danish coming in very largely on contract. I myself have a number of dairies contracted for all the year round, and then, in turn, have that sold on contract to retailers. It comes in to me on the Monday afternoon and goes right away to the customer on the Monday afternoon by rail, or by our own vans, if it is in the city. There, again, you have the retailer ready for use. You could not arrange that kind of trade with the class of butter that you only get part of the year.

1625. But the Danes really have made their organisation, both on this side and on the other side, very largely in view of this fact, that they had to do a continuous trade practically all the year round?—Yes.

1626. They have arranged their system of calving, they have arranged their own method of manufacture, and everything for a trade of that kind?—Yes, they have brought that system forward very beautifully; but our friends in the Colonies of Australia and New Zealand do not have a winter trade like that, and they cannot possibly have it. It is not possible for them to have a supply in their winter as the Dane makes a supply in his winter.

1627. That of course is a sufficient answer if that is the case—I mean to say if the natural conditions are such that they could not imitate the Danish practice, that of course is the answer I want?—That is the case.

1628. (*Chairman.*) Why is it not possible to make the same arrangements in Australia and New Zealand as are made in Denmark?—It is owing to climatic reasons.

1629. Are you aware that Danish cows are in the house for eight months in every year?—Yes, I know that.

1630. Why should not they have the same arrangement in Australasia?—The Danes are near to other parts of the world where they can get food stuffs in a time of scarcity. Quite recently—I think it is only three years ago—the Australians were able to send out but very little butter in their summer.

1631. It is a question of organisation, is it not?—No, there are other questions entering into it. There is the question of locality as well. I think I am right in saying that it is three years ago that the shipments were very considerably reduced on account of the drought in summer. Having no grass for the cattle in summer it was impossible they could have forage for them in the winter time. They have that sort of thing to contend with.

1632. Is there any preservative used, to your knowledge, in the importation of fresh meat?—No. I might have told the Committee that in Glasgow and the West of Scotland there is a very large trade done with the North of Ireland, and all over Ireland, in fact, in fresh meats. I think that is pretty largely peculiar to Scotch people; we there are well forward, you know, in all things.

1633. We think we are?—Yes, we do, and therefore we are just about up to date in that trade. There is a large portion of the Irish pig brought fresh into Glasgow, day by day, absolutely free from anything; it comes to us just as it has been cut up, in sides, only with the ham off; they retain the ham in Ireland to make an Irish ham of it. That is done in Belfast, in Derry, and in Cork. We get a three-quarter side absolutely fresh and free from everything.

1634. And then you cure it?—And then we cure it. We do not have any salt, we want no salt in it at all, and we cure it very mildly in brine, and send it out to our customers so. That is a large trade in Glasgow and the West of Scotland.

Dr. J. A. Voelcker.

Dr. J. A. Voelcker, called; and Examined.

1635. (*Chairman.*) I understand you appear on behalf of the Royal Agricultural Society?—I do.

1636. You have been conducting some analyses of food products in respect of preservatives, I think?—I have had a large number of samples of food products sent to me, and the presence of preservatives when it has occurred has come under my notice; and I have also examined preservatives separately.

1637. Perhaps you will tell us the result of your observations on milk first?—The preservatives that I have come across are mostly those that have been used for cream or for milk.

1638. There is a slight difference in our view between the preservatives in cream and those in milk, owing to the difference in the quantities which are used?—I cannot say that I could draw any clear distinction between the

Voelcker.

21 Nov. 1899.

preservatives that I have come across that have been used for milk, and those that have been used for cream.

1639. What I mean is the frequency of their occurrence in milk and cream?—The samples that I have had in my capacity as consulting chemist to the Royal Agricultural Society have come of course mostly from farmers, and in those cases there has been no question of the use of preservatives. Those samples have been sent to me by farmers on their own seeking for information for their own use, so that from them I have not had very much experience of preservatives. But I have also had going through my hands a large number of samples that have been sent in connection with the Sale of Foods and Drugs Act, and I have particulars with regard to the use of preservatives in these. In addition I have had a number of samples of preservatives which have been sent in their natural condition for the purpose of seeing what the composition of them was. With regard to the samples of milk I have found that boracic acid preservatives used as borax or as mixtures of borax and boracic acid have been the commonest in use.

1640. What is the greatest proportion that you have found?—I have had very little experience in the determination of the actual quantitative existence of these preservatives. I have occasionally to determine it. What I have found is that there is really so very much uncertainty with regard to them that one does not know how often they have been added on the way, or what portion of the sample has been taken. Really the whole thing has been so uncertain that there has been very little point in determining the actual quantity. I believe, for instance, that if you have a sample of milk that has been taken as it has been going the rounds you may get quite a different quantity of preservative according as you draw the sample from the top of the churn or the bottom of the churn, or the middle.

1641. What is the specific gravity of borax compared with that of milk?—The question is whether it has been thoroughly stirred up with the milk or whether the material has been undissolved and has fallen down to the bottom undissolved; so that I really have not gone fully into the question of the quantitative existence.

1642. And the same applies to cream, does it?—The same applies to cream, except that in the case of cream I know as a matter of fact that it is very commonly the case that the preservative is sprinkled just on the top, and that if you take the top portion you will get a very much larger amount than you will in any other portion of the cream; in fact, the lower portion may sometimes be quite free from preservatives. I have seen in different factories the cream put up in little jars, fresh cream without any mixture, and then some preservative sprinkled on the top. That is to my mind one of the greatest objections to the use of preservatives in cream—that you may take the top portion and practically get all the preservative in that part.

1643. Have you noticed any other preservatives besides boracic acid?—Boracic acid is the chief one. I have also come across in earlier times salicylic acid, but not for a long time, and as yet I have not found in any samples formalin actually existing.

1644. I understand—you will correct me if I am wrong—that you are speaking chiefly of samples sent to you by farmers?—No; I have had two sets of samples to go upon. The one set have been sent to me by farmers; those who are members of the Royal Agricultural Society, and they have sent their materials to me for advice, and for knowledge as to the quality of them—upon questions concerning their own dairies. In such cases as these one would not expect that they would send preservatives, or use preservatives in the materials sent. The other set of samples are those which have gone through my private laboratory in the ordinary course, which have been sent either under the Sale of Foods and Drugs Act, or which have been sent by private individuals. It is only in these latter ones that I have found the presence of preservatives to any extent.

1645. Have you made any researches into condensed milk?—Yes; condensed milk I have had also to do with. I have one analysis here that I can mention, where I found that condensed milk contained 0·51 per cent. of boracic acid. If the directions that were given on the tin were followed the quantity of boracic acid contained in a pint of the made up milk would amount to 11·37 grains—say 11½ grains.

1646. That is a very high percentage, is it not?—It is a very high percentage indeed.

1647. Do you consider it a safe percentage for the consumer?—I should not think so at all.

1648. Do you mind telling us what milk that was? I do not want you to say what milk it was unless you think you can do so safely; was it foreign milk or home milk?—It was Australian condensed milk.

1649. Containing 0·51 per cent. of boracic acid?—I happen to know that.

1649*. How long ago was that?—In 1898.

1650. I suppose you would call that a somewhat reckless use of a preservative?—I should call that certainly reckless; there is no excuse whatever for it.

1651. It is far beyond anything that is necessary for preserving the milk, is it not?—That is far beyond anything necessary; in fact, I hold that in condensed milk there is no need at all of any preservative.

1652. Have you made any other examinations?—I should like to mention with regard to the presence of boracic acid in the samples of milk that in the majority of the cases where boracic preservative was used the milks were found to be either adulterated by the addition of water, or that they were mixtures of separated milk and whole milk. Then I have had also samples of cream to examine, and in connection with them I have examined different kinds of preservatives. I have also found that a considerable number of samples of butter that have been submitted have contained boracic preservatives.

1653. Was that imported butter?—Many of these were home butters. I have also examined Australian butters, some of them with preservatives and some of them without.

1654. Were these preservatives in all cases boracic?—In all cases of the butters a boracic preservative is the only preservative that I have found, except, of course, salt.

1655. Have you examined any beverages?—Yes. I have analysed a considerable number of samples of cider which have been submitted to me. I found in certain low strength ciders—that is, ciders of low alcoholic strength—that salicylic acid had been used; either salicylic acid alone, or salicylic acid and glycerine which I found in some cases. All these have been American ciders, and the ciders have been those of low alcoholic strength, which would not have kept without the use of preservatives. They were brought to me by English makers of cider, who complained that they had to compete with American manufacturers, who were able, by the use of these preservatives, to get these low alcoholic strength ciders to keep, whereas otherwise they would not have done so.

1656. Did you undertake a quantitative analyses there?—No. I have not done quantitative analyses of these. I found in every case that salicylic acid was present.

1657. Under the Food and Drugs Act would any prosecution be sustained?—These samples came to me from cider makers directly, and they were not taken under the Sale of Food and Drugs Act, and so I did not go further into them. This happened in 1895, and in 1898.

1658. Did they come direct from the American producers?—No; they were brought to me by English manufacturers, who complained of the competition of the Americans.

1659. Would there be ground for prosecuting the vendor of such ciders?—I should say there would be ground in such a case as this. The quantity was decidedly large, I could tell that.

1660. Have you examined any temperance drinks?—No, I have not, but I may add that I have examined samples of jam and preserves.

1661. Factory jam?—Yes. I have one quantitative result here that I could mention. In a sample of strawberry jam 3½ grains, to the pound, of salicylic acid was found.

1662. It would take even a schoolboy a considerable time to eat a pound of strawberry jam. In the case of jam, would you regard the presence of a preservative as a safeguard against deleterious fermentation, or fungoid growth?—I should be inclined to regard the presence of preservative there as a means of avoiding other steps which ought to have been taken before—and as a decided objection.

1663. You would?—Certainly in this case, in which salicylic acid was found; I should certainly regard the presence of salicylic acid as an objection.

1664. Do you think that if the jam were properly and

Dr. J. A. Voelcker.

21 Nov. 1899.

carefully made it would be unnecessary?—I think if the jam were properly made, and the materials were sound, that there would have been no call at all for the use of salicylic acid, or any other preservative. The presence of a preservative such as salicylic acid there I should regard as very possibly used to hide the imperfections of the fruit, or the deficiencies of the manufacture.

1665. Have you any experience with regard to colouring matters?—Yes.

1666. They are also found in jam, I presume?—Yes. I have found the presence of aniline dyes in sweets, and in things like pop-corn. A few specimens of those I have had, but not many.

1667. Do you know anything about the colouring jams and preserved fruits?—I have not had much experience of that.

1668. (*Professor Thorpe.*) I think, in addition to your position as the analyst to the Royal Agricultural Society, you also act for certain local authorities in connection with the Sale of Food and Drugs Act?—I have not myself any appointment, my brother has; he is a public analyst.

1669. Then the illustrations you have given us are not actual analyses which have been performed by yourself?—Many of them have. Some few of the butters and ciders that I have mentioned to you were, for instance; but the analyses of the colouring of sweets, etc., have not been done under me; I have seen the whole thing, but it has not been reported upon by me directly.

1670. Then the occurrence of antiseptics, or preservatives in foods which have been taken under the operations of the Food and Drugs Act you yourself have no actual personal knowledge of?—No, for those I am not personally responsible.

1671. You stated that when preservatives, as, for example, these boracic acid things, are used in milk, there is a tendency for them to be not equally dissolved, or in some cases not dissolved at all in the sample?—Yes, I believe so.

1672. Surely if that were the case the amount used would be extremely and absurdly large?—That to my mind is the great objection, and that there is no check whatever placed upon it. When milk is brought from a dairy the man whose duty it is to send the milk away simply throws a handful, or whatever portion of a handful he thinks right, into the milk. That process may go on and be repeated by each one through whose hands the milk passes, the person so putting the preservative in not knowing how often it has been added already nor in what quantity. There is no even distribution of the preservative through the material, and no check whatever upon the quantity used. It is because of that uncertainty that I never, previous to this, have troubled particularly about determining the exact quantity of preservative in any particular sample.

1673. Have you actually seen the process of adding the preservative to the milk?—I have myself seen the preservatives added to the milk.

1674. By farmers?—Yes, by farmers. I have seen it in the case of milk going out of a dairy.

1675. Is it your experience that they do it in that somewhat haphazard way which you have described?—I have seen it done in that way, and I do not know anything to the contrary.

1676. It is the fact that the persons who vend these articles issue directions which indicate very clearly the amounts which should be used in the particular articles of food?—But the fact that there is no check upon the preservative used nor upon the quantity used constitutes to me the great danger and objection of the whole thing.

1677. In the case of the Australian condensed milk that you spoke of, that of course was an utterly exceptional sample, I should think?—Yes, that would be an exceptional sample; it came to me just in the ordinary way, though.

1678. How?—It was simply submitted by somebody who had it—some private individual.

1679. But what was the reason of the submission?—I do not call to mind just at the moment the circumstances under which it was sent to me. It was sent in 1898. It was not brought under the Sale of Food and Drugs Act.

1680. You do not remember the circumstance which led to your examining it?—No, I do not remember that.

1681. Was it known to exercise any injurious action on account of the large quantity present, or was there anything peculiar about the taste?—I do not call to mind the circumstances at all. I happened to determine the quantity of preservative, because I considered it rather exceptional to find any at all.

1682. Have you found certain Australian butters not to contain boracic acid?—Yes, but that was within quite recent times—this year, in fact. I have examined samples of Australian butter that were submitted to me by merchants. Some of them were without preservatives, and known to be without preservatives, and the others had a boracic preservative. I kept these samples for a considerable time in order to see how they kept. I simply say that when the samples reached me the one without the preservative was just as good as the one with the preservative, and it was only on keeping it for a very much longer period that any difference was noticeable. I had them in my laboratory for a matter of six weeks or so before you could find any difference; till then the one without preservatives was just as good as the one with.

1683. Do you infer from that that Australian butter might be sent to this country without the use of preservatives?—I should think that it would be quite possible; if the butter was properly made, I think it would be quite possible to send it so.

1684. Is your knowledge of the subject as regards the examination of Australian butters sufficiently large to warrant you in making any deductions as to the relative proportions of those which come with and of those which come without preservatives?—Personally, in the case of butter, I do not regard the question as nearly of the same importance as I do in the case of milk. According to my opinion it does not matter very much; the question is not such an important one with regard to butter.

1684*. That is not exactly what I wanted to know; I asked you if your examination of Australian butters had been sufficiently extended to enable you to tell us what proportion of Australian butters come without preservative?—No, I could not. My experience has not been sufficient in that.

1685. I understand from your synopsis that you have found rennet to contain boracic acid preservative?—Yes, I have.

1686. Is that common?—I do not know; it is only one sample that I had.

1687. You also speak in your synopsis of cattle-feeding cakes occasionally containing borax?—Yes.

1688. What is the object of adding borax there?—The case in which I have found feeding cakes to have a boracic preservative in is the case of cotton cake. The ordinary or common cotton cake—undecorticated cotton cake, as it is called—has, when fresh, a nice bright look, but after it has been kept a matter of three months or so, it soon gets a dark-looking colour. Farmers know this well enough, and they always prefer a bright-looking cake. That no doubt induced some manufacturers to see whether they could not get their cakes to preserve this bright appearance longer. So it was tried to mix boracic acid in a certain quantity with it. I have here two specimens of this cake to show the Committee, if it is of any interest to them. I have kept these for a good time. Certainly the cake that had a small quantity of preservative—the exact quantity, I may mention, was a pound to a ton—has kept its colour very much better, and looks brighter and fresher. (*Handing in samples.*)

1689. Is there anything in the nature of a fermentative or septic change liable to go on in a cotton cake?—If the seed has been sufficiently freed from moisture there is no reason at all for any fermentative change going on, but if the seed has been damped or damaged in any way, then a fermentative change may go on. That is the ground of my objection to the use of preservative, even in the case of cotton cake. If you have a preservative added to a feeding material like this, it is impossible to tell whether that preservative has not been used to cover the defects of inferior material to start with; also the use of a preservative even in the case of feeding cakes allows of a considerably larger amount of moisture being incorporated with the cake or other material, which to a certain extent is to the damage of the farmer. I was consulted on the point, at the time, as to what my views on the subject of adding preservatives to cattle feeding cakes were, and I have here my answer, if it would be of interest to read what I said then.

1690. Perhaps you might give us the substance of it?—One of those cakes is made with a preservative, and the other without. These cakes are already more than three years old, as June, 1896, was the time I had them. The one without the preservative is of a dark brown colour, and the other is much brighter, and is of a fresh colour. The substance of my reply was this, after stating that I had examined the two cakes:—"The objection to preservatives in the case of feeding cakes is that it would enable makers to put on the market cakes containing an excessive quantity of moisture, and hence to the detriment of the farmer, and secondly, it would facilitate the use of inferior and damaged seed, and give it a fictitious appearance, and thus be to the detriment of the manufacturer who uses the best and sound seed only." These are really the points on which I object to the use of preservatives for feeding cakes.

1691. You have told the Committee something of your experience with respect to the presence of colouring matters; now what experience have you as to the nature of the colouring matters which are used in dairy produce?—I know that they are used in milk and butter, of course, very largely. Those two things personally I hold to stand on a very different footing. I think there is no excuse whatever for the colouring of milk. With regard to butter you are under a different state of circumstances. A farmer has certainly difficulties, especially in connection with foreign competition, and he also has the very variable tastes of the public to deal with. As soon as the public see that a dairyman sends them a different coloured butter —and, presuming it to be perfectly pure and natural butter, uncoloured, the variations due to the time of the year and the feeding of the cattle will give a difference of colour to the butter naturally—then the public say they like the butter always the same, and they get suspicious as soon as there is any alteration of colour. The dairyman, I take it, colours his butter in order to produce a uniform appearance of it at all times. The colouring is done, not by way of making the butter appear something else—it is not like making margarine, for instance, look like butter—but it is done simply to meet the whims of the public. Now, for the colouring of milk, on the other hand, I think that there is no excuse at all, because there the colouring, where it is done, is done with the purpose of making a milk which is naturally thin appear as if it were rich, and this constitutes, to my idea, a fraud. Therefore, I think it would be well that a difference were made, and that colouring in milk should be absolutely prohibited. With regard to the colouring of butter, from my own point of view I am really not so particular. I do not know whether you are dealing here with the question of the differences between the colouring of butter and of margarine.

1692. Personally, I should like to have your view, and to know whether you can defend, or otherwise, the colouring of margarine?—My view with regard to that is this, that butter and margarine stand on different grounds. Margarine has got a colour of its own. If it is coloured it is done to make it look like butter. Where the dairyman colours butter it is not done to make it look like something else, and there is not, to my idea, any fraud in that, because it is simply done—not to introduce a different article on the market, different to what it really is—but simply to meet the whim of the public. They want the butter of a uniform colour, and the farmer, as I have said, has got very great difficulties to contend with, because people are not sufficiently aware of the fact that butter, by the natural changes of the year, and the feeding of the cows at the different times of the year, alters its colour naturally. Therefore, the farmers' colouring of the butter is done out of self-defence, because he has to compete with the foreign butters, one great virtue of which, in the eyes of the public, is that they always look the same. Now the colouring of margarine is, to my mind, on a quite different footing, because there the colouring is done in order to make the margarine look like a different article altogether—not a variation of the one article, but a turning of the one article into the other. The absence of colouring matter in the margarine would afford an easy means of detection, which the public might be well aware of. The colouring of butter is a different matter to my mind altogether. But I may say on the general question that I do not hold particularly strong views, speaking even on behalf of the British farmer, about this question of colouring of butter generally; in other words, I would rather advise the farmer to give up the colouring altogether if by the giving up of that he could secure the non-colouring of margarine. I do not think that butter and cream, which are materials more or less luxuries, and which are consumed only in comparatively small quantities, are at all to be compared with a substance like milk, which is more distinctly a food, and which is taken in large quantities. Therefore, in any evidence I should give I would like to draw a clear distinction between my views as regards the use of preservatives in milk, and as regards the use of preservatives in these other matters, cream and butter.

1693. And colouring matter, too?—Yes, and similarly with regard to colouring matters.

1694. Have you any information as to the character of the colouring matters which are used in milk and in butter?—Not very much.

1695. You have not had the examination of those things?—No. I have not done much in the examination of them of late.

1696. Have you anything to tell the Committee with respect to the use of colouring matters in other articles of food, as, for example, peas—has that subject come within your observation?—I cannot say that it has very largely; my work is mostly concerned with the Royal Agricultural Society, and I have not had much personal experience outside that.

1697. As a member of the Society of Public Analysts, have you taken up any particular attitude with respect to this question of the colouring matter of peas?—No. I have not taken up any attitude on that question, because I have not gone enough into it.

1698. (*Dr. Tunnicliffe.*) Having examined the samples of milk which you had which contained boracic acid, can you say whether they have been in any way decomposed? —No, they have not been decomposed; the preservative has kept them.

1699. It has kept them from decomposition?—It has.

1700. You have had no instances of milk containing preservatives which have also, at the same time, been decomposed?—No, I cannot say that I have.

1701. They do occur, of course?—Yes, they do occur, but I have not had one.

1702. With regard to the Australian butter without boracic acid, which you examined, could you tell us what time of the year it was; had that anything to do with it?—The Australian butters were examined by me about five months ago.

1703. That would be in the summer, then?—Yes, in the summer.

1704. I think you said that you thought the presence of salicylic acid in any quantity in jam was inexcusable—or something to that effect?—I think so, because salicylic acid is a known drug.

1705. You are aware of the fact that there is a large trade in imported fruit?—Yes, I am aware that that is so.

1706. Could you support what you said with regard to the use of preservatives when used for preserving fruit pulp, even in small quantities, to make jam? Take apricots, which is a notorious instance; nearly all the apricot jams are made from imported apricot pulp?—Yes, I know. I should object to it, and, on the ground that I put out, namely, that when you use the preservative you hide the original nature of the material, and the use of a preservative enables a material which was not proper food to be utilised. I do not say that it must of necessity be bad to begin with, but the use of a preservative covers defects.

1707. I take it that it would be quite impossible for the public to get apricot jam at the price they do at present if the apricot pulp were not imported?—Quite so.

1708. And it would be practically impossible to import the apricot pulp without the use of the preservative?—Yes. But, all the same, I should object to having my preserves with preservatives.

1709. May I ask if you have had any case under your observation of any deleterious effect produced in cattle by the preserved feeding cake?—No. I have not, for the simple reason that it has not been adopted.

1710. Has it not been used?—I had the case I mentioned brought before me, which was submitted for my opinion as to the likelihood of the preserving process being carried out successfully, and I have ever since then been on the look out for it. I have found occasionally borax used in cakes, and I have always reported on their presence, but I am safe in saying that it is practically not used.

1711. Is formalin used at all with cattle cake?—No, I do not think so. I am constantly testing these

Dr. J. A. Voelcker.

21 Nov. 1899.

samples for the presence of preservatives, but I think we have kept them out so far.

1712. (*Dr. Bulstrode.*) Do you think it would be possible to add preservatives to milk so as to veil the effects of the partial decomposition?—Do you mean when decomposition has begun?

1713. When decomposition has commenced and is practically apparent, although in a small degree, do you think that by adding preservatives it would be possible to veil that decomposition?—I should doubt whether you would be able to veil it entirely; at all events you would have to use very large quantities of preservative, and I should think success would be very doubtful.

1714. Do you think that the addition of preservatives to butter would enable the retailer to mask the rancidity of the butter?—I do not think so, when rancidity has once started; but there again the danger lies in the use of materials, which are made under such bad conditions that they will not keep, and where the vendors know perfectly well that they will not keep, but the addition of preservatives enables them to palm off things which ought not to be allowed to go into trade. Those are my views.

1715. That they would be decomposed but for the preservative?—Yes; that is what I mean. Take, for instance, a milk that has been got from cows that are kept under insanitary conditions; such milk ought not, in my opinion, to be sent out as the food of the people. If that milk were sent out in its natural condition, made in these bad surroundings, the milk would probably go bad. The use of preservatives and the liberty to use them enables the vendors of materials which would not keep to send them out into commerce to compete with materials which are made under proper conditions, and which are intrinsically good.

1716. Do I understand you to really advocate the abolition of preservatives altogether; would that be your view?—No, my position would hardly be that. I should certainly like to see the use of all preservatives for milk stopped, but at the same time I am bound to recognise that there may be certain circumstances under which some excuse for their use may occur. What I should advocate is that if there is no hope of seeing the use of preservatives stopped altogether, it should be obligatory that a declaration as to their having been used should be given. That I should apply not only to milk, but also to cream.

1717. Could you tell us how many specimens of Australian butter without preservative you tested?—I did about half-a-dozen.

1718. What was the date?—About six months ago.

1719. Do you know the origin of the butter?—I know the origin, because it came through a friend of mine who went over to Australia really to push the butter trade there. His object in bringing them to me was to know whether it was necessary to use a preservative or not.

1720. Did you gather from him that much butter is imported into this country from Australia without a preservative?—He only, of course, had to do with his particular firm. The question that they were about to consider was whether they should use a preservative, or if they might be able to do without it.

1721. Had this butter which was without a preservative been brought over, and sent to you as a test case?—Yes.

1722. Only in a small amount just to test it?—No; there were deliveries brought over which were consigned to merchants here, and I had samples taken from them.

1723. How long after leaving the vessel or leaving the cold chamber did the samples reach you?—They were in the cold chambers, and they came to me the next day after being taken out of the cold chambers; then I had them in my place certainly about six months; up to only a month ago I had them.

1724. And you found that both kept equally well, you say?—For the first four or five weeks both of them kept quite well—equally well; there was no difference between them; it was only after about six weeks that I could find any difference in their keeping qualities.

1725. In the temperature of your laboratory?—Yes, in the temperature of my laboratory, where of course the surroundings were not very good.

1726. How much boracic acid had the other sample—the test check sample?—I have not got the figures; I do not know the exact amount.

1727. You give it as an actual fact that one had no preservatives?—Yes, I know that one had no preservative whatever.

1728. (*Chairman.*) How was it kept in your laboratory—was it open?—Just open, as it might be on the table; no precaution was taken.

1729. And you observed no change for six weeks?—That is so. I kept it six weeks and then I took it home and kept it there a bit longer.

1730. (*Dr. Bulstrode.*) Then, as regards that experiment of yours, it would go to show that there would really be no need for preservatives in the case of Australian butter?—I believe that if they made the butter under proper conditions there would not be any need.

1731. By proper conditions do you mean thoroughly cleanly and relatively aseptic conditions?—If made in thoroughly cleanly ways and in a proper scientific way I think the butter would keep perfectly well with the aid of cool chambers; but, as I have said, I am personally not at all particular about butter having preservatives.

1732. It is rather a question as to the possibility of this butter coming over here without preservatives; we have had a good lot of more or less contradictory evidence on the subject?—I beg your pardon; of course I did not know that.

1733. (*Chairman.*) Have you heard from farmers that different pastures produce butters of different keeping qualities?—Yes, just in the same way as they say certain pastures will not make cheese.

1734. That is a well recognised fact, is it?—I am very sceptical about these points. I think that in nine cases out of ten it is something that is faulty in the surroundings. If the butter was made properly, and all the sanitary arrangements were in good order, and there was a good water supply, and the cows were healthy, I do not think with regard to our butter here that there would be any need whatever for the use of preservatives.

1735. Are you aware that Danish instructors in Ireland have failed to make butter of the same keeping quality as the butter made in Denmark?—In Denmark they will not have the preservatives at all, I believe.

1736. That was not my question; but I asked you if you were aware that Danish instructors in Ireland had failed to produce butter of the same keeping quality as Danish butter?—No, I cannot say that I was aware of that.

1737. (*Dr. Bulstrode.*) Would the experience which you have had in testing various articles of food for preservatives lead you to form any idea as to the extent to which preservatives are used in one food and another?—No. The evidence that I have given with regard to jams and sweets, and things of that kind, is really only based upon isolated cases; I have no wide experience of that at all.

1738. (*Chairman.*) I asked you just now if you were aware of certain matters in Ireland; I only mentioned it because we have had evidence before us lately to the effect that owing to the quality of the pasture in Ireland it was impossible to make butter so dry as in Denmark, and therefore the Irish butter did not keep so well; but I did not wish to put that upon you, as I am not giving evidence, and you are in the box and not I?—I had not heard that; I have not followed it up.

1739. (*Dr. Tunnicliffe.*) Do other conditions, apart from the pasture, which you have just considered, and apart from the actual keeping of the milk, affect the keeping of the milk as it is got from the cow?—Certainly they do; anything of an insanitary nature, or even keeping it in a close place would.

1740. I am speaking of conditions affecting the cow herself; I think you have spoken of milk from cows kept under sanitary conditions?—Yes.

1741. Did you refer to conditions outside the cow or inside the cow?—If the cow is in bad health the milk will not keep.

1742. It will not keep?—Certainly not.

1743. Do you think that butter could be brought from Australia without the addition of preservatives, and be good when it is put into the market here if no sterilising agent was used; do you include in proper butter-making the sterilisation of cream?—In butter-making from Australia?

Dr. J. A. Voelcker.
21 Nov. 1899.

1744. Yes. You spoke of "proper conditions"; would you include the sterilisation of milk as a necessary condition?—No, I do not think so.

1745. Then you were thinking of it without sterilisation?—Yes. Take Italy, for instance. I am aware that the Italian butter which comes over is made from sterilised cream——

1746. (*Dr. Bulstrode.*) Sterilised or Pasteurised?—People use these terms so vaguely now that I am not sure.

1747. (*Dr. Tunnicliffe.*) We have heard objections to butter made from sterilised cream on the ground that the aroma of the butter, the bouquet, would disappear; however, you think it could be done without sterilisation?—Yes, I think it could be done without sterilisation.

1748. (*Chairman.*) Thank you. I do not think we need trouble you further, unless you have anything else that you think it would be useful for us to know?—There is only one matter, if I might be allowed to mention it, just to make myself clear on what I hold to be the most important point—that is, the distinction which ought to be drawn between milk and cream and butter. Milk is, of course, a material which is used in very large quantities; it is a regular food, and it is used not only by ordinary healthy people, but also by relatively weak people—children, and so forth. That is one reason why I draw such a strong distinction between the use of preservatives and colouring matters in the case of milk, and the use of similar articles in the case of butter, at all events, and, to some extent, in the case of cream. There is one other matter I should like to put on record with regard to cream, and that is the objection I have to the use of preservatives when the presence of them has not been declared. As I mentioned, it is very frequently the case that in the making up of these small pots of cream the cream is put in and a little preservative sprinkled over in solid form—a little powder sprinkled over the top. Cream is a material which is often used by children under medical advice. I may speak from personal knowledge. I have an infant that is at present ordered to have a certain amount of cream mixed with the milk. If I purchase a pot of cream and somebody unknowingly takes out the top spoonful and mixes that with the milk, my unfortunate infant will get a very decent medicinal dose, which I did not bargain for when I purchased the cream. Therefore, I think that cream ought not to be used with a preservative unless the presence of that preservative has been declared; in other words, if I buy cream for infants or any other purpose, I ought to get cream, and I do not want any admixture of boracic acid or salicylic acid or any other preservative. I take this opportunity of mentioning what is my view of the great difference that ought to be drawn between milk, cream, and butter used with these preservatives.

1749. When a person asks for "fresh milk," "fresh cream," and, possibly, "fresh butter," you think he ought to get an unmixed article?—Butters, as I say, I do not care much about, but certainly in the case of cream or milk—milk more especially—I think a person asking for these ought to be entitled to have them free from any preservative, and that if it may not be desirable to prevent the use of preservatives altogether, then it should be made a necessity that, if present, their presence should be declared. I further think that the quantity of the preservative should be limited. At the same time, I recognise that we know very little indeed about the quantities that may be harmful and otherwise, and that is a matter which ought to be investigated. I think their presence should be declared, and the quantity should be limited, and that it should be a matter for experimentation to find out more clearly than we know at present in what quantities these materials are safe or not to use.

1750. (*Dr. Bulstrode.*) Would the views which you have put forward as regards either the abolition or the control of preservatives in one or other food be views which would be supported by the Royal Agricultural Society which you represent?—Well, I must not pledge my society too much, but I am representing views which I think it would be to the interests of agriculturists to adopt. Professor McFadyean, who is here, would of course speak more on the medical points.

Professor J. McFadyean, M.B., called; and Examined.

Prof. J. McFadyean,
M.B.

1751. (*Chairman.*) As we know, you are Principal and Dean of the Royal Veterinary College?—Yes.

1752. We are very glad to have the benefit of your evidence. Will you be good enough to state what are your opinions upon the subject which is referred to us?—The opinions which I am prepared to express relate only to the addition of preservatives to milk, butter, and cream. My evidence will be mainly from the physiological point of view. I desire to support the most of what Dr. Voelcker said in a general way, and some things I would be disposed to put considerably stronger than he did. I object entirely on principle to the addition of any sort of preservative to milk. I think that no preservative is necessary. The addition of a preservative is undesirable, and in most cases the preservative which it is desired to add is physiologically indefensible. I think that the statement which I believe has been made that some preservatives may be added in quantities sufficient for the purpose in view—that is, to arrest the propagation of bacteria in milk, and yet not be hurtful to the consumer, ought to be accepted with great caution. I do not believe it. I think that even the most harmless of these substances, such as boracic acid, when used in quantities that would be sufficient to stop bacterial action in milk, might very well be distinctly injurious to the consumer, especially to a child, who would be taking perhaps a pint daily.

1753. There are also, I suppose, some morbid conditions in which a person would receive injuries from consuming a substance which, if in perfect health, he may take with impunity?—My point is that these substances will always inflict injury, though no doubt they can be taken in quantities where the injury is inappreciable. I am also under the impression that boracic acid is added in quantities much larger than in the case referred to by Dr. Voelcker. I think Dr. Voelcker said it was present in the proportion of a half per cent. in the condensed milk, but that it would be present only in the proportion of about eleven grains to the pint when the condensed milk was diluted according to the directions. I do not believe that the diluted milk would have been preserved. The preservation would have ceased on dilution—in other words, to preserve ordinary market milk with boracic acid would probably require four or five times that quantity of boracic acid. When boracic acid is added in the proportion of a half per cent. to milk—and I do not think anything less would be serviceable for the purpose in view—an infant might very well take thirty or forty grains of the boracic acid in twenty-four hours; and it is incredible that that could be taken for a period of months to the advantage of the child. Then I also want to bring out strongly this point—that with rare exceptions milk as it comes from the cow has not got the essential agent of fermentation—that is to say, it contains no germs at all. The two principal factors which are concerned in fermentation of milk are, first—and this is the most essential of them—that germs should gain access to it, and secondly, temperature. To sanction the addition of such things as boracic acid to milk would predispose to the neglect of the proper precautions that ought to be taken to keep milk in the state in which it comes from the cow—fresh. It is a matter of common knowledge—at least, it is a matter well known to all those who have to do with milk—that its proneness to go wrong or to sour at a given temperature largely depends upon the amount of dirt in it or the amount of dirt that has been left adhering to the vessels through which it has to pass. If those who purvey the milk know that they are at liberty to throw in boracic acid to the extent of a half per cent., they will certainly be more careless regarding the elimination of impurities from the milk.

1754. Have you any knowledge or suspicion to what extent preservatives are used in milk, say, in this city?—No, none. I am speaking from the general point of view; I am assuming that preservatives are used, and I am objecting to them on principle, but I have no knowledge personally as to the extent to which they are used or the amounts in which any individual preservative is used.

1755. Have you taken any precautions to protect your own household from milk treated with preservative?—Yes, I take the only precaution that is open to me, and that is to go to what I take to be one of the most respectable companies that charges the highest price for its milk.

1756. Do you extend the same objection to the use of preservatives in butter as you do to milk and cream?—Yes, I think the only preservative that is physiologically defensible in the case of butter is salt. I think these other materials are objectionable, as they are certainly foreign to the body. They are in no sense food materials, and the most that can be said in their favour is that they are used in quantities that will not be seriously, *Prof. J. McFadyean,* M.B.

21 Nov. 1899.

perhaps not appreciably injurious. They cannot be said to be necessary, for butter may be brought any distance and can be kept sweet provided the temperature is regulated. Butter is not a substance more prone to go wrong than the muscular tissue of an animal, and we know that that can be brought from the ends of the earth in a perfectly fresh condition—and so can butter, if necessary.

1757. There are certain volatile oils in butter that are apt to change or disappear, are there not?—They might disappear, but that would not bring on fermentation, or, I think, sensibly alter the taste of the butter; and I doubt whether any of the things which are added with the view of preserving the butter would prevent the volatilisation of any of these volatile agents.

1758. Assuming the proportion of a half per cent. to be the minimum necessary for preserving milk, the same proportion used in preserving butter would not be attended with the same risk to the consumer, would it?—Nothing like the same risk. I quite agree with what Dr. Voelcker said, that the question of milk and of butter on that account are somewhat different; but as regards the general question, I think that in both cases the use of the preservative is not to be defended from the physiological point of view at any rate, and it cannot be said to be absolutely necessary.

1759. Would you be satisfied if the sale of butter which had been treated by preservatives as "fresh butter" should be prohibited, and that such butter should only be allowed to be sold as "preserved butter"?—I should object to having sold to me butter preserved with anything else than salt unless it were declared that it contained something else, in which case I should decline to buy it. I do not think it would meet the case to simply sanction the use of, say, boracic acid and salicylic acid and things of that sort, in butter, provided the butter were labelled "preserved," because, after all, the common preservative of butter is still salt, and people would be deceived, as they would think they were buying butter with salt only.

1760. There has been a great change in the amount of salt used in preserving butter of late years; people will not buy the high-salted butters of past years now, will they?—No, I think not; but that is a question of the length of time for which the butter is kept. A comparatively small quantity of salt will keep it quite sweet for a week or two; if it has to be kept for months, it requires a very high proportion—a proportion that renders the taste unpleasant to most people.

1761. Now, I would like to ask you a question on a subject Dr. Voelcker made some observations upon—namely, the effect of pasture upon butter; have you any experience to enable you to form an opinion on that?—No, I have never had brought under my notice any such case, but I am firmly convinced that the observation depends upon error—that a wrong interpretation has been placed on the circumstances. We know that milk in all circumstances is a fluid that is admirably serviceable for the growth of all sorts of bacteria—at least, the great majority of the bacteria that are found in the air and around about; and it is so serviceable that one can hardly conceive that any condition of the pasture would make it more serviceable—that no matter what the condition in which the cows are kept they will never yield milk that will remain sweet if left in ordinary circumstances, because the agents that determine souring are practically ubiquitous.

1762. Pardon me, I think you have misapprehended me; the point that has been brought before us by more than one witness is that the butter produced from certain pastures is of a soft texture, and that no amount of handling or manufacture will make it as dry as the best samples of Danish or Colonial butter?—I think it is quite possible that the nature of the food would very probably affect the texture of the butter, but I do not think it would sensibly affect its keeping properties. If two samples of butter made in different places were found to have different keeping properties, then I should think that it was some other local circumstance that explained it, and not the difference of the diet, because all samples of butter will go wrong without the addition of a preservative. It is quite clear that there might be other circumstances sufficient to explain it—such as a larger proportion of germs in the place. Take the case of Denmark; it is quite conceivable that the germs which are concerned in the alteration of butter when it goes wrong may be more numerous in the atmosphere or in the surroundings of the dairy in Ireland than in Denmark—it is at least conceivable—and the butter would therefore go wrong sooner in Ireland than in Denmark.

1763. The instances stated in evidence were those of Irish creameries where presumably the management was good?—Presumably, but still it is possible that they are not quite so clean as the Danish ones.

1764. (*Dr. Bulstrode.*) Could you supply the Committee with any evidence in support of the statement that boracic acid would, physiologically speaking, always inflict harm?—Do you mean any experimental evidence?

1765. A reference to any evidence or any experiments of your own?—No, I do not think so; nor is it to be expected. I simply infer it in this way: that this is a material which is entirely foreign to the body, which is not utilisable as a food material, and which will not pass through the alimentary canal unchanged, but which must be absorbed. If you use it in considerable quantities you can show that it is detrimental to the animal, and from that I infer that when you use it in small quantities it is also detrimental to the human subject.

1766. Beyond general physiological principles you have no evidence to bring forward?—I have no specific case.

1767. Do you think that the abolition of the prohibition of preservatives would have the effect of enabling a larger amount of partially decomposing milk to be offered for sale?—I do not think that the addition of boracic acid would make milk that has already gone wrong marketable; I am sure it would not. It is not one of the antiseptics that remove the previous signs of putrefaction or of souring in milk.

1768. Could you tell the Committee what physiological manifestations accrue from the exhibition of large doses of boracic acid of say 30 grains?—To an adult human being? I think the exhibition of 30 grains as a single dose would scarcely have an appreciable effect on an adult human being; about 10 grains up to 30 would be the doses in which it would be prescribed as a medicinal agent, but it is not often prescribed for any purpose.

1769. Five to 15 in the British Pharmacopœia?—If 5 to 15 is the dose which physicians think to be a safe one for the adult human being, then it is obviously an enormous dose, which a child might get with milk containing it in from a half to one per cent.

1770. That is to say, assuming that the basis of the British Pharmacopœia is a sound one, and that the dose fixed is founded upon proper physiological observations, the addition of preservatives as they are used in milk would be likely in practice to produce a physiological result?—I find it incredible that 30 grains of this substance foreign to the body could be taken in daily for months and be without effect; and that effect I cannot conceive to be useful.

1771. Do you know anything of the condition in which boric acid is given off in the urine?—No, I do not.

1772. Do you know anything as to the effect of boric acid or salicylic acid on pathogenic organisms in the presence of milk?—Only in a general way. It is a rather feeble germicide. It is not of much use where the purpose is to kill bacteria, but it is very useful where the purpose is to restrain their growth, and that is all that is done in milk. The addition of boracic acid to milk is practically without effect so far as the killing of the germ is concerned. It does not even kill the comparatively harmless germs that are concerned in the milk going wrong; it restrains their activity, and they would immediately resume it if the milk were diluted, so as to lower the proportion of the boric acid.

1773. Do you think the effect of abolishing the use of boracic acid would be to raise the price of milk?—No, I do not think so.

1774. Do you think it would make milk fresh in appearance and in taste more difficult of attainment?—I feel confident it would not. It might lead to some slight alteration in methods of farming. The moment that milk and butter brought a better price land that is at present used for cropping and for other purposes than the feeding of dairy cows would immediately revert to dairy purposes. That I should think would be the natural tendency.

1775. Have you had any experience of the administration of boracic acid to patients suffering from one or another disease?—No. My experience as to its injurious effect is based on the fact that it is harmful apparently to such living things as bacteria, because a thing that is not harmful to these living things is useless as a preservative. I infer, therefore, that it will also be harmful to animal cells provided it comes into contact with them in appreciable quantities.

1776. (*Chairman.*) Might you not say the same of common salt?—No; salt is a material that enters in a large amount into the composition of the human body;

it is a food material in moderate quantities, and in that respect it is entirely different from boracic acid. As I have said, salt is the only preservative that appears to me to be physiologically defensible in the case of butter, as sugar is defensible in the case of fruits.

1777. Salt is inimical to most bacterial growth, is it not?—It is an exceedingly feeble preservative; it is much less powerful in that respect than boracic acid.

1778. (*Dr. Tunnicliffe.*) Then I take it that what you say is that any substance which is foreign to the animal body is physiologically indefensible to be added to food?—As a preservative?

1779. Well, in any way whatever?—Unless there were a necessity.

1780. The question of necessity does not come in here at the present moment; that is your general statement?—Yes.

1781. Then we could not meet you on the question of quantity in this case?—No; I am afraid not.

1782. Would you still hold your view in case we reduced the quantity very considerably?—No, because the quantity is already defined as regards its lower limit. You may so use it in a degree of dilution that would make it useless for the purpose in view; it must be used of a strength that will restrain bacterial action.

1783. Is it not a question to some extent of time?—No.

1784. Not at all?—No; a preservative is a substance which immediately arrests bacterial growth.

1785. Do you mean to say that you would have to put the same amount of boracic acid into milk to keep it one day as to keep it two, or to keep it three?—Certainly; it would be an inefficient preservative if it went wrong on the third day; it would not be preserved. You may of course add what is called a preservative, and yet not preserve your milk; but milk which is preserved for one day——

1786. Is preserved for ever?—Is indefinitely preserved.

1787. Then we are using the term "preservative" in a different sense. For the purpose of trade time is an important thing, as we have had it stated before us?—Yes.

1788. If we would keep milk or butter, for instance, over three months or two months it would meet all requirements?—Yes, if you could keep butter over three months.

1789. Or two months even?—Yes.

1790. Therefore we are hardly using the question of preservatives in the same sense?—I quite see your point.

1791. I mean there is a time limit. However, your position is that we cannot meet you in regard to quantity in this matter?—No. Take the case of milk——

1792. Take a substance like formalin, for instance, which can be added in very minute quantities indeed, and will preserve for a certain time limit; that is foreign to the animal body?—Yes.

1793. And therefore you would object to it on those grounds?—I should strongly object to formalin.

1794. You would?—Strongly.

1795. On *a priori* grounds, I take it?—Yes, on *a priori* grounds.

1796. You said that these preservatives might have an effect, and I gathered from you that it does not necessarily follow that because an effect is not appreciable it does not exist?—That is so, when the observation is carried over a comparatively short period. But it would perhaps be going too far to say that, if one were to make a series of experiments extending over twelve months, and on a considerable number of individuals, to whom the drug was administered in a specified quantity, and then had observed no bad effects——

1797. Then after such experiments you would be satisfied?—Yes.

1798. Then, as I understand, the statement you make is one of a general physiological character. I take it that you mean that, *a priori*, because one did not observe a result it by no means follows that some micro-chemical injury did not take place in some tissue or the cells; I assume you do take it in that sense?—I do.

1799. You adhere to that sense?—Yes.

1800. Now, what about a substance like pepper, which I take it is foreign to the animal body?—I do not think so. Pepper is composed of carbon, hydrogen, oxygen, and nitrogen. It is not like boracic acid, which contains a mineral substance that is not found in the normal body. I think it is conceivable that pepper might in digestion actually furnish energy. I do not suggest that it does, but, at any rate, it is on a different footing to boracic acid.

1801. Therefore you would suggest that we might use strychnine as a preservative, if it acted?—No; I do not suggest that you might.

1802. Why not strychnine?—Because strychnine is known to be injurious. It would be absurd to suggest that you should use a thing that is known to be injurious. My point is, you do not know that boracic acid is not injurious.

1803. What you mean by a substance foreign to the animal body is a substance which, when split up into its elements, is foreign to this animal body?—Yes.

1804. I take it that in boracic acid it is the boron that you object to?—Yes.

1805. But that would not hold with regard to strychnine?—No; but of course I really do not see that that affects my argument with regard to the boracic acid.

1806. It affects it in this sense, that of course it might be possible to get another preservative—for instance, formalin; would you object to formalin?—Yes, I object to that, but not on the grounds of its chemical composition.

1807. You do not object to it on the ground of chemical composition?—No. I object to it on the general grounds that I have already mentioned, that it is selected because it is a thing opposed to life.

1808. That is what I was going to ask you further about, if you would be kind enough to tell me. It is quite possible, is it not, to select a substance which, although it may be a protoplasmic poison to low forms of life, may not appreciably affect higher forms of life?—Yes.

1809. I mean on general physiological principles one might expect *a priori* that such would be the case?—The substances which are injurious to bacteria are not always injurious to animal organisms in the same degree, but as a rule they are injurious to both. The things that will kill one will kill the other in moderate concentration, but there are some exceptions.

1810. Take a substance, for instance, like formalin; if you expose a bacterium or a germ to formalin in certain proportions it kills it straightway?—Yes.

1811. If you expose an animal like a man to formalin, it does not kill him straightway?—In the same concentration?

1812. In the same concentration?—I was not aware of that.

1813. The simple reason, I take it, is, that because in the case of the organism——?—I did not quite apprehend you a minute ago; you asked me to assent to the statement?

1814. Yes; do not think I am cavilling for a moment, because I am not?—I do not think so, of course.

1815. I take it I am right when I say that you object on several physiological grounds?—Yes. Take, for example, boracic acid; I object to that on *a priori* grounds, but I also object on certain other grounds.

1816. On *a posteriori* grounds?—Yes. I object to a legal sanction being given to the addition of certain things to food materials when we are very far from being able to assert that they are without injurious effect.

Dr. J. A. Voelcker, recalled.

1817. (*Chairman.*) I think you wish to add something with reference to what you have just heard Professor McFadyean say?—Yes. Referring to what has been just stated, formalin, of course, stands on a different ground from a chemical point of view. Formalin stands on a different aspect to boracic acid in its distinctly known chemical action. Formalin has a distinct action on the albuminous portions of food and on the casein of milk, for instance, rendering it hard and indigestible.

SEVENTH DAY.

Wednesday, 22nd November, 1899.

PRESENT :

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).
Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary.*

Dr. E. Walford.

22 Nov. 1899.

Dr. EDWARD WALFORD, called ; and Examined.

1818. (*Chairman.*) You are a Doctor of Medicine of the University of Durham, and you hold a diploma in public health of the University of Cambridge ?—Yes.

1819. You are also Past President of the West of England and South Wales Branch of the Society of Medical Officers of Health ?—Yes.

1820. I understand you have been for some time Medical Officer of Health of Cardiff ?—Yes, I have been Medical Officer of Health for the urban and port sanitary districts since January, 1888.

1821. In the course of the discharge of your duties have you had to undertake inquiries under the Sale of Foods and Drugs Act ?—Yes ; the Sale of Foods and Drugs Act is carried out by the inspectors of my department.

1822. Do you make a large number of analyses in the course of the year ?—The Public Analyst does. I am not a public analyst, and I do not analyse. The Public Analyst for Cardiff is under agreement to analyse 600 samples in the course of the year.

1823. Do his reports come under your notice ?—Yes, those reports are sent to me.

1824. Are they made to you ?—Yes, they are made to me.

1825. I think you have prepared a memorandum or report on the subject of the use of antiseptics for the information of the Sanitary Authority of Cardiff ?—Yes, that is so.

1826. What view do you take generally as to the use and effect of the modern antiseptics such as boric acid ?—The chief antiseptics of which I have had any knowledge have been boric acid, and occasionally small quantities of formalin. The view that I take is that it is undesirable that these substances should be added to foods ; it is possible that injury to health might accrue by the administration of food containing them.

1827. Does that apply to all forms of foods, solid as well as liquid ?—The only foods of which I have had any knowledge in which these preservatives have been used have been butter and milk—milk chiefly. Of course, preservatives are used in other foods, but, coming under my own personal knowledge, butter and milk are the chief foods with which I have had to deal.

1828. Is the use of such antiseptics general in your experience ?—Yes, it is general and rather on the increase, I think.

1829. Should you say that the greater part of the milk coming into Cardiff was treated with boracic acid ?—No, I think not the greater part. I do not think about more than 8 per cent. of the samples showed it—perhaps a little more—8 to 13.

1830. Eight to 13 per cent. ?—Yes, that is about the proportion. In 1898 the Borough Analyst reported that the proportion was 8.5 per cent. In a report which he presented later, out of 145 samples of milk he found 13.8 per cent. contained boric acid.

1831. Was his analysis quantitative ?—Yes, it was. He reported specially on that point.

1832. What was the maximum and minimum percentage contained in those samples ?—The lowest percentage was 0·004 per cent. ; the highest percentage was 0·105 per cent.

1833. How many grains would that give to a quart of milk ?—0.05 would give 7 grains to the quart ; 0.1 would give 14 grains to the quart.

1834. In your opinion would such a proportion be harmful to the consumer ?—I think it might, and certainly in the case of milk where a young child—an infant—might be fed entirely on such milk.

1835. I suppose we may look upon boracic acid as a drug ?—Yes, it is certainly a drug, and it is used medicinally.

1836. Do you think there is any necessity for protecting the public from the unconscious consumption of a drug ?—I think so. I think that when foods are preserved in this way by chemicals it should be announced by label or other proper notice that they do contain this substance.

1837. If that precaution were imposed upon dealers would you be satisfied to allow the use of the boracic acid as an antiseptic if its presence were notified in every case ?—No, I do not think I should. I think even then a certain danger arises in the consumption, because you cannot rely altogether upon people really understanding what a preservative means ; they would hardly know that it was dangerous. I think under any circumstances the addition of this substance is unnecessary.

1838. I suppose of course you recognise that it is convenient to the trader ?—Yes, it is convenient.

1839. Have you formed any opinion how far a preservative enables him to dispense with scrupulous cleanliness in vessels, and in the handling of milk generally ?—I think it might do so, because unless the milk is kept scrupulously clean decomposition will set in earlier, and the addition of the preservatives might probably delay the decomposition.

1840. Is boracic acid the only preservative of which traces were detected in the milk ?—The analyst reported that he had discovered minute traces of formalin, but he did not state the amount.

1841. Then as to the butter, what was the analyst's report on the butter samples ?—With regard to the butter 92 samples were examined during the same period, that is, during 1898, and 44.5 per cent. contained boric acid preservatives.

1842. Were any proceedings taken in consequence of these reports ?—In one case only proceedings were taken. That was a case in which the amount amounted to 1·02 per cent., which gives 71·4 grains per lb.

1843. Was a conviction obtained ?—There was no conviction. The case was dismissed as the defendant produced a warranty that the butter was sound.

1844. A warranty from whom ?—From the wholesale dealer.

1845. And proceedings were not taken against the wholesale dealer ?—It was found impossible to get hold of the wholesale dealer ; but even if that had not been so, the proceedings would have had to be for giving a false warranty. There could not have been proceedings for specific adulteration.

1846. Do you think it is possible that the preservatives can be applied to conceal incipient decay and putrefaction or deterioration ?—Yes, I think it is probable that that would be so. Certainly these preservatives delay decomposition, and therefore the milk may be stale at any rate ; incipient decomposition might have commenced, I take it, and the preservative might prevent any noticeable decomposition occurring.

1847. Have you formed any estimate of how much boracic preservative an ordinary individual might consume unconsciously in the course of twenty-four hours?—No, I have had no personal experience of that. I should think it would vary very considerably. Some persons might be very susceptible to the drug, such as young children or infants.

1848. That was hardly my object in asking the question; what I mean is, seeing that a great variety of articles of food seem to be treated in this way, the consumption of a variety of articles by one individual might form a large aggregate of boric acid taken into the system?—Yes, that is so.

1849. But that, of course, is quite uncertain?—Yes, it is quite uncertain.

1850. Have you had any analyses taken of the bacon and ham?—The analyst has not reported the presence of any preservatives in those substances. We have had samples taken, but not with the particular object of finding out the preservatives—they have been given to the analyst in the ordinary way.

1851. (*Professor Thorpe.*) Can you tell us whether the seasons have any influence upon the presence of boracic acid in the milk?—No, I am afraid I cannot give you any information upon that point.

1852. You do not know whether it is more likely to be added in summer than in winter?—I should imagine that it would be more likely to be added in the summer, but I cannot tell you that from any personal knowledge.

1853. You have stated, I think, that the use of these antiseptics was on the increase?—Yes, I think it is.

1854. Which particular antiseptic shows the greatest amount of increase, do you think?—Practically, I think my evidence is confined to boric acid.

1855. Is there no evidence to your knowledge that the use of formalin is extending?—The analyst merely states that very small amounts are added, and he does not give the amounts. I have not, therefore, any knowledge as to whether the amount is increasing in the case of formalin, but it seems to be increasing in the case of boric acid.

1856. I gather that it is your opinion that boric acid interferes with the normal process of digestion?—Yes, that is so.

1857. Even in very small quantities?—In small quantities, that is to say, in the quantities that are usually added for preservatives, that is, say, 0.05 per cent. of boric acid in the case of milk. I think it is probable that some derangement and delay certainly in the process of digestion would be occasioned.

1858. How do you arrive at the probability?—I have read various experiments which have been made. For instance, experiments have been published recently by Dr. Rideal and Dr. Foulerton. They have made experiments upon the presence of these preservatives in milk, and although they came to the conclusion that very little derangement to the digestive organs was produced, at the same time there did appear to be a certain amount of derangement and delay in the case of the digestive processes.

1859. Do you not think it is possible with the very small quantity, such as, for example, is to be found in milk, which we may say is normally preserved, that is to say, with the amounts which are stated ought to be used by the persons who vend these preservatives—is it not possible that the process of digestion might even be accelerated by those very small quantities?—If it is accelerated it is interfered with; but I do not know that there is any evidence to show that it is accelerated to any extent

1860. But what is the positive evidence to show that it is deranged?—In the case of various digestions; for instance, in the case of salivary digestion there is evidence of a certain amount of delay in the digestion; in the case of pancreatic digestion, and in the case of peptic digestion also, there is a certain amount of delay in the process.

1861. (*Dr. Tunnicliffe.*) You say in your synopsis that 0.25 per cent. is the amount required to preserve butter; could you give us any facts upon which that statement rests?—I believe that is the experience of those who have experimented upon the subject. I have had no practical experience myself, and I have made no experiments myself.

1862. You have no idea even how long a time that would preserve butter for?—No, I cannot say how long that would preserve it for.

Dr. E. Walford.

22 Nov. 1899.

1863. With regard to the question of the action of boric acid upon digestion, the experiments which you quote were experiments made on the action of pepsin in glass, were they not?—There are two sets of experiments I quoted; in the first case those made by Chittenden and Cripps, and the others those made by Rideal and Foulerton. They were all experiments made in glass vessels, I believe.

1864. Technically *in vitro*?—Yes, quite so.

1865. Do you regard the results obtained in that way as giving us very important data with regard to human beings?—I hardly think so. The conditions are not the same as in an ordinary human being under normal circumstances.

1866. The differences produced even in these experiments *in vitro* you would agree are very small, would you not?—Yes, very small.

1867. Have you had any cases of boric acid poisoning?—No, never; I am not in practice.

1868. You have not had brought under your attention any cases of poisoning from milk which you have suspected have been due to boric acid?—I have had none brought under my own knowledge.

1869. You have had a very wide experience in milk, I take it?—Yes, but I have had none brought under my personal knowledge.

1870. Do you hold, may I ask, a very strong view with regard to the advisability of prohibiting preservatives?—I do not know that I hold a very strong view. I hold the view that the public should be protected from taking these chemical substances unless they are aware of what they are taking. If they ask for genuine fresh milk and they get milk with a chemical, I do not think that that is right.

1871. Would your objection be mostly met by an indication of the presence of a preservative?—It would be met, to some extent, I think.

1872. You do not think, for instance, that the addition of preservatives to food is physiologically indefensible?—The physiological experiments have apparently been hardly sufficient to enable one to form an opinion on the subject, but, at the same time, I think there is evidence of injury to the digestive process in the experiments, and if that could be proved it would be certainly indefensible.

1873. Do you think it is largely a matter of quantity of the preservative?—Undoubtedly the quantity used would have a very considerable influence.

1874. Do you think it would be possible to add preservatives in such a quantity as yet to preserve within a certain limit and not to hurt?—I think it is doubtful, indeed.

1875. (*Dr. Bulstrode.*) You say in your synopsis that the maximum dose of boric acid for a child one year old would be about three grains?—Yes, I think it would.

1876. Then in the beginning of your synopsis you say, "That in any case the limit of 0.1 per cent. of boric acid should not be exceeded. This would give about seven grains of boric acid to the pint of milk." But assuming that this is right, that the physician would use three grains of boric acid to produce some physiological result in a child, why would you, therefore, sanction that the child shall have presumably a far greater physiological result produced by giving it, say, fourteen grains of boric acid?—In my report I meant that under no circumstances should more than that amount be given. That will, of course, give really more than the three grains; undoubtedly it should not exceed that, and I do not think it ought to come up to that amount.

1877. Suppose the dose applied to yourself would be, we will say, ten grains three times per day—that would be about the Pharmacopœial dose, would you see no objection to having 20 grains three times a day in addition?—I think it would be an objection.

1878. Would you not consider that that is a reason against the at any rate indiscriminate use of preservatives? Suppose a physician wished to give you ten grains three times a day, he might from the fact that you are already taking ten grains three times a day in your milk, possibly be giving you 20 grains three times a day?—Quite so; I think that is undoubtedly a danger. Many of the articles of food—milk, butter, and so on—which you take at a meal might be adulterated.

1879. Do you know the conditions under which the physician would hesitate to prescribe boracic acid?—In certain cases where there is any gastric irritation I should think he would—cases of diarrhœa or chronic catarrh of

Dr. E. Walford.

22 Nov. 1899.

the stomach, or of any irritability of the mucous membrane—I should think he would hesitate then, and possibly in some cases of nervous diseases, or in cases where there is a possibility of the person being subject to skin eruptions.

1880. Do you think that the physician would prescribe it rightly in cases of diseases of the kidney?—I really cannot say; I do not know that he would, but my experience of prescribing is so very limited now.

1881. Do you know anything of the supposed action of boracic acid upon the muscular fibres of the uterus?—No.

1882. If what I am going to read to you as to the use of borax is the fact, would it lead you to modify your opinion at all:—"On account of its asserted power to increase the uterine contraction it ought either to be avoided, or employed with care during pregnancy." Now, suppose that is true—we will not discuss whether it is true or not—would you see any objection to prescribing boracic acid to pregnant women?—Yes, undoubtedly there would be an objection to it, if that is so.

1883. Would you say that is an objection to the indiscriminate use of preservatives in food?—Yes, I think it is.

1884. Could you tell the Committee how many births there were in Great Britain during last year—approximately—or, say, how many births were there in Cardiff during last year?—There were 5,520 births in Cardiff in 1898.

1885. Then assuming what I have just read to you to be true, there were possibly a certain portion of that 5,500 who would be having in their milk boracic acid in conditions in which its administration was contra-indicated?—Yes, quite so.

1886. You state that preservatives are unnecessary; now briefly upon what do you base that statement?—I think chemical preservatives are unnecessary; for instance, there is no reason that I know of why milk, and why butter should not be preserved in other ways, by the refrigerator, for instance, by ice and cold. It is a question of keeping the milk below the temperature that will suffice.

1887. I understand from your evidence that in Cardiff a large amount of the milk is supplied without preservatives?—Yes, that is so.

1888. Would that be the basis for your statement that preservatives are unnecessary?—I think they are unnecessary, because it is unnecessary to preserve milk for any length of time at all, and if it is necessary to preserve it, I think that the preservation can be brought about by refrigeration.

1889. You have done a considerable amount of work upon diarrhœa, I think, as well as upon diphtheria?—Yes. I have made some enquiries with regard to the presence of diarrhœa.

1890. Can you tell the Committee when infantile diarrhœa is most prevalent in England?—It is most prevalent during the third quarter of the year—July, August, and September.

1891. It is supposed to be prevalent during the hot months of the year?—Certainly.

1892. Are those the months during which you think it is possible that most preservatives will be added to the milk?—I think so.

1893. Have you ever considered the question as to whether possibly, having in view your statement with regard to the influence of boric acid upon certain conditions of the intestinal tract, that the infantile diarrhœa in this country may possibly be kept up, or prevented from falling by the more or less indiscriminate use of boracic acid in the milk of the people?—I think it is quite possible, and it has been stated so. I have never myself really investigated the question from that aspect, but I think it is highly probable that the diarrhœa might be kept up by the addition of boric acid to the milk.

1894. Is the mortality from infantile diarrhœa decreasing?—It fluctuates very much. It varies almost with the temperature; that is to say, the amount of the autumnal diarrhœa—the summer diarrhœa—varies most distinctly with the varying temperature. The higher the temperature is in the summer the greater will be the diarrhœa.

1895. Do you think that the sanitary progress which has taken place in this country ought on general principles to have produced some diminution in infantile diarrhœa?—I think it ought.

1896. More than it has?—Yes.

1897. Do you think that will be one factor for supposing it possible that boracic acid might be instrumental in keeping it up?—I think it is highly probable; certainly the infantile diarrhœa is very closely connected with the administration of milk as a diet.

1898. I understood you to say, in answer to Dr. Tunnicliffe, that you would not attach much importance to physiological experiments done outside the human body?—No, I do not think they can be relied upon as evidence of what will happen in the body.

1899. To what evidence would you attach the greatest importance in considering this question?—Physiologically? Of course, feeding experiments, if they were made systematically, would be of great importance.

1900. Would you think those of more importance than experiments made outside the body?—I think so.

1901. (*Chairman.*) Have you made any enquiries or observations as to how the preservative is applied to milk and cream?—It is applied, I believe, in the form of powder; it is a mixture usually, I believe, of borax and boric acid.

1902. Are you satisfied that it is thoroughly mixed in all parts of the milk?—No. Sometimes it has been found, as a matter of fact, I believe occasionally in a solid form.

1903. That would somewhat vitiate the analyses?—Undoubtedly it would. I should think that is of rare occurrence, but I believe it has been found in a solid form.

1904. We have had it in evidence that a common way of applying it to cream is just to sprinkle it on the top?—I believe that is done, but I was not aware that it was a very common way of doing it.

1905. In that case, of course, the preservative would not be mixed thoroughly?—Hardly.

1906. And whoever took the top spoonful of cream would get an extra dose of it?—Yes.

1907. What effect does cooking have upon boracic acid. Suppose fresh milk were treated with boracic acid, and afterwards boiled, would the preservative remain?—Yes, I think so.

1908. Without alteration of properties?—I think so.

1909. Your duties take you into a very populous district?—Yes. Cardiff is rather a populous place; we have over 186,000 people living in it.

1910. It has been represented to us that if the use of these preservatives were prohibited the supply of milk to such populous districts would be very seriously interfered with; is that your belief?—I do not think it would. I am under the impression that it is rather a recent custom to add these chemical preservatives; formerly I do not think there was any difficulty with regard to the supply of milk.

1911. Is it not the case that the populous districts are very much better supplied with milk now than they were a few years ago?—I believe they are.

1912. If the alternative were before you of prohibiting chemical preservatives at the risk of stinting the milk supply, would you hesitate to adopt it?—I would rather put the question in another way. Which do you think most important—an ample supply of milk or a strictly pure supply of milk?—I think a strictly pure supply would be the most important.

1913. And you speak with the full knowledge of the wants of an industrial population?—Yes.

1914. (*Dr. Tunnicliffe.*) Have you had any experience of a sample of milk exhibiting to a certain extent decomposition and also containing a preservative?—No, I have not.

1915. Have you had any experience with regard to what I may term chronic ptomaine poisoning—I do not mean the acute ptomaine poisoning?—No, I cannot say that I have had any personal experience of that.

1916. You do not know anything about chronic ptomaine poisoning?—I have had no personal experience of it, and I know nothing about it beyond what I have read, and so on.

1917. (*Professor Thorpe.*) You said that you thought in the case of boracic acid cooking or boiling the milk would not affect the amount of the antiseptic present; is that also true of other preservatives, do you think?—I am afraid I cannot quite answer that question from my knowledge.

1918. Would it be true, for example, of formalin, do you think?—No, I should hardly think it would be. I

Dr. E. Walford.

22 Nov. 1899.

should think when evaporation took place that some changes would occur.

1919. May I ask where Cardiff mainly gets its milk supply from?—From Somersetshire very largely, from Devonshire and Gloucestershire, and from the surrounding districts of Glamorganshire and Monmouthshire.

1920. Can you tell us how long it is after the milk leaves the farm—I mean, roughly speaking, and as an average—before the milk reaches the consumer in Cardiff?—I should think as a rule six or eight hours probably—something of that sort.

1921. I think you said that the use of preservatives is on the increase in Cardiff?—Yes, I think it is.

1922. (*Chairman.*) I have not asked you any questions about colouring matters; has your attention been directed to them at all?—Colouring matters are added slightly, but I have no personal knowledge as to the extent.

1923. They are used in other substances as well as milk?—Yes, in milk and butter.

1924. In preserves?—Yes.

1925. In preserved fruit and vegetables?—Yes, they are added to those.

1926. But you have no personal knowledge of that?—No.

1927. (*Dr. Tunnicliffe.*) I gather from what you say that you think the use of preservatives in milk stands somewhat on a different level to the use of preservatives in butter, for instance?—I think the addition of preservatives to milk is a more serious question than the addition of preservatives to butter, for the reason that milk forms the exclusive diet of a class of the community—infants, for instance, and children and invalids.

1928. (*Dr. Bulstrode.*) You were asked just now whether if preservatives were done away with there would be any difficulty in supplying the population with fresh milk, and you said you thought not?—I do not think there would be any at all.

1929. Do you know Austria?—Not personally, as I have never been to Austria. I believe that in Austria, and in France, and in Germany, chemical preservatives are prohibited altogether for sale amongst the populations.

1930. Take Austria; the Austrian population is—am I right in saying—about 36 millions?—Yes, I think it is about that.

1931. Supposing the milk supply of the Austrian population can be carried on without the use of preservatives, do you from your intimate knowledge of the conditions of the population in England see any reason why the same should not obtain here?—Certainly not.

Mr. Richard Augustus Cripps, called; and Examined.

Mr. R. A. Cripps.

1932. (*Chairman.*) You are a Fellow of the Institute of Chemistry?—Yes.

1933. Do you appear on behalf of any public body or society?—No, entirely privately.

1934. Do you practise as an analyst?—Yes.

1935. Where has your experience chiefly been?—In Hayward's Heath; that is where my laboratory is.

1936. Have you devoted any time to research into the presence and effect of chemical preservatives in food?—Into the effect of them I have; but my experience of testing samples for preservatives has been small.

1937. I understand that you have made experiments to test the effect of a preservative upon the digestive ferments?—Yes, in regard to boric acid only.

1938. Can you describe your experiments?—My experiments were directed to ascertaining whether boric acid has any influence on the digestive ferments which digest starch and albumen, and also on the rennet ferment.

1939. Would you make your statement?—Shall I describe the methods I have used, or is that immaterial?

1940. (*Dr. Bulstrode.*) I think it is material that we should have the methods briefly outlined, and if we wish for more information we can ask for it?—Certainly. First, with regard to the amylolytic ferment, I used for this purpose diastase—that is, malt extract—and saliva, and in each series of experiments a certain proportion of potato starch. The solution of starch was submitted to the action of the ferment in the presence of various proportions of boric acid, and there was also a blank experiment in each case containing no boric acid. The termination of the digestion was shown by the usual process of testing with weak iodine solution, as no definite coloration is produced when the whole of the starch has been converted into sugar. There is an intermediate stage when the starch is converted into dextrine, but that still gives a colouring, and I carried the experiments right on to the production of sugar. My results were that boric acid had absolutely no influence when using the infusion of malt upon the time required for digestion, although I used as a maximum proportion of boric acid one per cent. In the case of saliva, I mixed the saliva with nine times its volume of water and filtered that solution. This was then employed in exactly the same way as the infusion of malt. I might perhaps quote these figures, as there is a slight variation: Using 0·2 per cent. of boric acid I found digestion complete in eight and a half minutes; using ½ per cent. and 1 per cent., in each case it was complete in nine minutes; with smaller proportions as 0·01 and 0·05, it took ten minutes. 0·02, ten and a half minutes; and with no boric acid and with one tenth per cent. it took eleven and a half minutes. I therefore conclude that so far as chemical experiments show, boric acid, even in the proportion of one per cent. has no detrimental influence upon the conversion of starch into sugar either by the natural ferment of the saliva or by the diastase of malt.

1941. May I ask one question in reference to that before you pass on to the next point? Your experiments do not agree with those of Weber, published in the American "Journal of Chemical Science"; you know that probably?—I am not aware they do not agree.

1942. Weber has recorded the retarding influence of borax on salivary digestion; Cripps, on the other hand, finds that boric acid has little influence on salivary digestion; you are not familiar with the paper to which I have referred?—No, I am not.

1943. You cannot explain the discrepancy at which you have arrived?—No. If I read the paper I daresay I could do so, but I have not read it.

1944. (*Chairman.*) Your experiments go to show that salivary digestion is rather promoted by the use of boracic acid than otherwise?—They would rather show that than otherwise, although the difference is so little in time that it is scarcely justifiable perhaps to make that assumption; I would rather put it that there is no detrimental influence. My next experiments were upon the digestion of albumen by pepsin. For this purpose five grammes of the finely-divided albumen was mixed with 100 cubic centimetres of water containing one per cent. by volume of hydrochloric acid of the British Pharmacopœia—that is, to all practical purposes, 0·35 per cent. of real hydrochloric acid gas.

1945. (*Professor Thorpe.*) Would you indicate what was the albumen?—The white of egg.

1946. Perhaps it is desirable to say that?—Certainly it is desirable; it was the hard-boiled white of egg. To this mixture, divided into several portions, was then added boric acid in such quantities that the liquids should contain proportions varying from 0·01 to 1 per cent. of the acid. The temperature was raised to blood heat, then five cubic centimetres of a 2 per cent. solution of pepsin added. In this case, as the final reading of the result is a little difficult, I put on duplicates in the most important experiments—that is, those containing the smaller proportions of boric acid. I found that the whole of the albumen had passed into solution in 45 minutes in those experiments in which one per cent. of boric acid, a half per cent. of boric acid, and 0·02 per cent. of boric acid had been used—that is one of those with 0·02 per cent.; in 50 minutes, 0·2 per cent, 0·1 per cent., 0·05 per cent., and 0.01 per cent., and one of the blank experiments containing no boric acid at all; and in 60 minutes the remainder, one of those being also a blank. I should explain that it is not easy to observe the entire solution of the albumen to a few minutes, and so a matter of five minutes in the term of an hour is not of great consequence. It will be seen therefore that on peptic digestion boric acid has no retarding influence.

1947. (*Chairman.*) Were your experiments repeated more than once?—In some cases they were duplicates. I might mention that there was a difference of five minutes in some of the corresponding tests, and in some of them

Mr. R. A. Cripps.

22 Nov. 1899.

both came out at the same time. That simply shows what I was expressing just now, namely, that you cannot depend for five minutes on it. But the general result is that there is no retarding of the digestion by pepsin: practically the whole of the albumen dissolves in far less than the time given; it is the remaining more difficultly soluble shreds that one gets which take the time to dissolve.

1948. (*Dr. Bulstrode.*) Have you read Professor Chittenden's paper on the influence of borax and boracic acid on digestion?—No, I have not.

1949. He says, after quoting his experiments: "From these results it is evident that borax tends to inhibit the amylolytic, or starch-digesting power of saliva"; so there were two papers, and two workers have arrived at different results to that at which you have arrived?—I think that is borax; I think I can explain that part from another author. Borax has not the same action as boric acid.

1950. It is borax in the instances in Professor Chittenden's paper?—Shall I refer to that now, or later when I have finished my experiments.

1951. You had better go on as you have arranged it in your mind?—The next series was with the use of zymin as a digestive agent. For this purpose a solution of the zymin and bi-carbonate of sodium was made, and also a solution of boric acid in fresh milk containing one per cent. The solution of boric acid in milk was then added in varying proportions to more fresh milk in order to produce solutions containing from 0·01 to 1 per cent. as before.

1952. (*Dr. Tunnicliffe.*) Might I ask you to repeat what you said as I did not quite follow it?—Practically it was this: that the zymin in alkaline solution with bi-carbonate of sodium is made to act upon a solution of boric acid in fresh milk, the object being to show the digestive action of the zymin on the caseine of the milk. The milk having been raised slightly above blood heat has then added to it the solution of zymin, and at various intervals it is tested for the digestion of the caseine by means of nitric acid. Five cubic centimetres of the liquid are mixed with one cubic centimetre of a 2 per cent. solution of nitric acid. When it no longer coagulates the digestion is complete. I found that in every case except that containing 1 per cent. of boric acid the digestion was complete in two hours and twenty minutes, and in the case of that containing 1 per cent. in two hours and thirty minutes. The influence therefore is slight in the case of a strong boric solution. Finally, I examined the action upon the rennet ferment. For this purpose to fresh milk at blood heat was added a solution of the rennet ferment (chymosin) and varying proportions of boric acid were also added to determine its influence. I found that in each case the milk had set into curd in from six to seven minutes, and that containing 1 per cent. of boric acid was decidedly firmer than the others. Those are my own experiments; they are entirely chemical, I have made no physiological experiments at all. My own view is that this question turns upon that point—upon the physiological action of boric acid upon the system—and that of course I am utterly incompetent to deal with. Referring to what you were just saying, there was a paper read by Mr. H. Leffmann, of the Franklin Institute, published in their Journal of February, 1899, in which he concludes as follows, if I may just read two or three short paragraphs:—"Moderate doses of borax up to five grammes per day, even when continued for some time, are without influence upon proteid metabolism, and do not exert any specific nutritional changes. Under no circumstances, so far as we have been able to ascertain, does borax tend to increase body weight, or to protect the proteid matter of the tissues. Borax when taken in large doses tends to retard the assimilation of proteid and fatty foods, increasing notably the weight of the fæces and their content of nitrogen and fat. With very large doses there is a tendency toward diarrhœa and increased excretion of mucus. Boric acid, on the contrary, in doses up to five grammes per day is wholly without influence in these directions. Boric acid in doses up to three grammes per day is practically without influence upon proteid metabolism and upon the general nutrition of the body."

1953. (*Dr. Bulstrode.*) You are reading now from Mr. Leffmann's paper, are you?—Yes. I have just transposed those paragraphs to make it consecutive. I connect one with boric acid and the other with borax.

1954. Holding those views do you agree with Mr. Leffmann that the use of preservatives in milk should be rigidly excluded?—Yes, I do for milk, because I think that is exceptional. The ground I should take upon that matter is this—that it will become a large medicinal dose of boric acid for a child who lives practically upon milk. As far as I am aware we do not know sufficient of the action of large doses of boracic acid for that to be considered innocuous. I think it is a question really for a medical man.

1955. In other words, you are not inclined to attach much importance to the conclusions arrived at experimentally outside the human economy?—No, not in a case like that where you are giving large quantities to quite young children; but in the case of butter and many other foods in which the actual quantity of boracic acid introduced into the system mainly of older people would be small, the influence, I take it, so far as chemical experiments show, would be nothing. It is wholly a question of the action when introduced into the system as a medicine, so to speak.

1956. (*Chairman.*) Would you be able to let us have those figures?—Certainly. They have been published in the "Analyst" for July, 1897. I have a copy here.

1957. (*Dr. Bulstrode.*) Then may we take it from you that in spite of the results of your physiological work which appear to agree generally with that of Professor Chittenden's, you still hold that boracic acid should be prohibited in milk?—Yes, certainly, in milk.

1958. With regard to the addition of borax to such things as butter and cream, what would be the teaching according to you of the results you have obtained?—That it is absolutely harmless—I would recall that "absolutely harmless"—that it has no effect on digestive processes.

1959. Do you think that one would be right in inferring from the result of these experiments that no harm would accrue in certain diseased conditions in connection with which it is asserted the exhibition of boracic acid is contra-indicated?—That I think is rather a question for a physiologist or a medical man.

1960. (*Dr. Tunnicliffe.*) You have given us now all the experiments you have made, I take it?—Yes, practically all of any importance.

1961. You have not made any experiments with weaker solutions of pepsin?—No.

1962. You say you took, I think, a 2 per cent. solution of pepsin?—Yes.

1963. In 100 centigrammes of water?—Yes.

1964. And 5 grammes of egg albumen?—Yes.

1965. Am I right; did I catch the numbers correctly?—Yes, quite right; only it was a small quantity of that 2 per cent. solution; the 2 per cent. solution of pepsin was added to it in small proportions.

1966. I did not catch that?—It was only five cubic centimetres of that 2 per cent. solution, so that really it was quite a small proportion of pepsin.

1967. Where did you get your egg albumen from; was it the commercial product?—I simply boiled eggs for a definite length of time, that is 10 minutes, then cooled them in water, took off the shells, and rubbed the albumen through fine wire gauze to get it into a state of division in which it should be uniform. That is the usual process for the digestion of egg albumen adopted by analysts.

1968. (*Professor Thorpe.*) Are you a public analyst, in practice?—No, I am in private practice.

1969. Have you no appointment in connection with any local authority?—No, nothing at all. I may say I have no commercial interest in this matter. My practice is not connected with agricultural work or dairy products.

1970. May I ask if you are recognised in the profession as having taken up a particular attitude with respect to the influence, or otherwise, of boric acid?—Only from this paper, which I published, I believe; I have no special standing in the matter.

1971. You are not, for example, retained in a case which is now *sub judice*—the case against Hudson Brothers?—No.

1972. Have you given evidence in matters of this kind?—Never on the question of boric acid in food.

1973. (*Chairman.*) Have you promoted any inquiry into the presence of colouring matters in food?—Not at all. I took this series of experiments up merely as a matter of interest.

1974. (*Dr. Tunnicliffe.*) Have you dealt with salicylic acid?—No. I have not touched any of the other preservatives, and I have touched none of the colours.

Mr. Samuel Archibald Vasey, called; and Examined.

Mr. S. A. Vasey.

22 Nov. 1899.

1975. (*Chairman.*) You are, I understand, a Fellow of the Chemical Society, a Fellow of the Institute of Chemistry, and a member of the Society of Public Analysts?—I am.

1976. And a consulting chemist?—Yes.

1977. You came here as representing the "Lancet"?—That is so.

1978. I understand that you have conducted a series of experiments in the examination of foods and beverages, undertaken for the "Lancet"?—That is so.

1979. Would you state the result of them?—The examination of the foods and beverages I have undertaken for the "Lancet" has extended over some ten years. The articles of food and beverages found on analyses undertaken by me to contain a preservative were as follows:—Meat peptone, intended for invalid use; beef-jelly, for invalid use; milk, lager beer, limejuice, grape juice, apple juice (cider), lemon squash, and sausages. The preservatives found in these articles were benzoic acid, formaldehyde, salicylic acid, boracic acid, and borax. I should like to point out to the Committee that in some instances where the "Lancet" commented unfavourably on these preparations containing preservatives, communications were ultimately received from the vendors of these articles intimating that they could possibly see their way to leave out the use of the preservative, and these communications were followed by samples, which were sent in, which on analyses were found to be free from the preservatives previously found. This was more particularly so with lager beer and cider.

1980. Was that British cider or foreign cider?—British cider, not imported cider.

1981. (*Professor Thorpe.*) Was it British lager beer?—It was not British lager beer; it was imported German lager beer.

1982. (*Chairman.*) What was the preservative in that case?—In the case of the lager beer it was salicylic acid.

1983. And also in the cider?—In the case of the cider it was salicylic acid also.

1984. Samples have been submitted to you since free from those preservatives?—Yes.

1985. Did you understand from the vendor that he would be put to any inconvenience by making his articles pure?—He regarded the report as damaging to his interests—the report, I mean, which mentioned that the cider or the lager beer had been treated with a preservative.

1986. Did he complain that the trade was interfered with by discontinuing the use of the preservative?—No; he made no communication of that sort at all. He simply stated that it would injure his interests to say, as we said, that both the lager beer and the cider in the instances I am referring to contained a preservative which was somewhat animadverted upon.

1987. Do you say that among the preservatives you found there was borax?—Yes.

1988. May we take it that that was boracic acid or pure borax?—Both boracic acid and borax have been found. The borax generally refers to milk, and, I should add, to meat peptone also, and beef jelly, and such things as are generally intended for invalid use.

1989. In what proportions did you find it in these substances?—I have very little evidence to offer on that question of proportion.

1990. Your analysis was not quantitative?—It was restricted simply to the finding the presence of the preservative without going so far as to estimate or give its amount.

1991. Would the producers or vendors of those articles communicate with you?—Nearly always.

1992. Did the manufacturers of peptone and invalid jellies discontinue their use?—I am not aware of that. I should like to point out that in the course of the inquiries undertaken by the "Lancet" I was appointed to inquire into the supply of milk to the great metropolitan hospitals. The results were published in the "Lancet" on January 1st, 1898. Apart from the fact that seven only of the samples proved to be of good, rich quality, three of them gave distinct evidence of boric acid, and one of formaldehyde. In this case I ventured to suggest to the Committee that the hospital authorities should obtain a guarantee from the milk dealer that the milk supplied to the hospital for the purposes of the sick should be free from preservative. Whatever opinion may be held with regard to the effect of preservatives on persons in health, it would surely be conceded that the addition of a chemical antiseptic to milk for the sick is most undesirable, and should be absolutely prohibited. The same applies, I think, also to milk for infant use. It follows, too, that articles of food like beef jelly and peptone, which are intended especially for invalid use, should not be preserved with a chemical substance, which may frequently defeat the treatment of the medical man.

1993. Did you detect the presence of chemical preservatives in all the samples of invalid foods?—Yes, practically all.

1994. Did you form any opinion as to whether their presence was necessary or whether they could be preserved without it?—I formed some opinion on that. I may say I am now speaking of my experience of ten years. These samples were obtained some years ago, but I should like to point out that I have examined and reported upon for the "Lancet" since samples of lager beer, lime juice, grape juice, and meat preparations without any indications of these containing preservatives. I think this tends to show that with proper care in the manufacture the addition of preservatives in these substances is unnecessary.

1995. On the other hand, within the last ten years is it within your knowledge that the use of preservatives has largely increased?—Yes.

1996. Have you considered whether it is desirable to require vendors to notify the presence of preservatives?—Yes; I think it is.

1997. Would you have them notify the quantity, the proportion, present?—I am not sure that I would have them notify the proportion present. I would rather suggest that there be a limit on the quantity used.

1998. A maximum not to be exceeded?—Yes, a maximum not to be exceeded.

1999. It has been objected before as to that, that some of the preservatives, and especially the colouring matters used, being not easily soluble, are not equally distributed through the substances—sulphate of copper, for instance.—Yes, in peas.

2000. And that there might be a larger quantity in one bottle than in another?—Quite so.

2001. Would that be an objection in your view to imposing that restriction?—I do not think so. I think the attempt could be made to apply it to a pretty large quantity of the peas concerned—to the pound tin, for instance. That seems to be determined largely on what the analyst is able to do. Small samples are taken, and it may be possible to over-estimate copper, or under estimate it; but it seems desirable in that case to estimate the copper in a very large quantity.

2002. Do you think it would be possible to classify foods into those in which it would be permissible to use preservatives, and those in which it would not?—That is my opinion, and I was about to suggest that to the Committee. May I just give my opinion about that?

2003. If you please?—I am of opinion that in some cases and at certain seasons the use of a preservative cannot be dispensed with; but I think that this preservative should be specified by statute, and the maximum quantity permitted to be used—that is the point you raised just now. In any case I think the fact of an article of food being preserved should be notified, but at the same time I think the purchaser should be able to demand an article free from preservative; in a word, I would schedule the foods which it would be permitted to allow the addition of a preservative to, and I would schedule also the preservative and the maximum quantity to be used.

2004. Do you think it would be feasible without unduly harassing the trade?—It is difficult to give an opinion upon its bearing upon trade interests, but I have thought over the question, and I think it would be feasible. I think in a word that legislation should be directed against the abuse rather than against the use of antiseptics. There is another point I should like to bring before the Committee, and that is the question of the limitations of the antiseptic power of a given preservative. I believe it is well known that so many grains of boracic acid suffice to preserve a pint of milk, so that, given a pint of milk

Mr. S. A. Vasey.
22 Nov. 1899.

so treated, if another pint of milk were added the mixture of two pints would not keep. Clearly then there is a limit to the preserving power of boracic acid. Now, it seems to me that if the quantity employed for preserving milk is just sufficient for preserving it, there is very little left of the antiseptic power of that boracic acid to act upon the organism. I throw that out as a suggestion. Clearly, there must be a limit to the antiseptic power of the various preservatives, boracic acid, salicylic acid, and so on, but it is a very distinct limit as I have just said. If it is found that so many grains of boracic acid are required to preserve a pint of milk, then, if you add another pint of milk to that, clearly you have not got enough antiseptic present. That seems to me to bear very much upon the physiological action of the milk so treated. Does the action of the preservative go further than its preserving action upon the milk in acting upon the organism?

2005. Have you collected any evidence on the subject of colouring matters?—No, I have not collected any evidence, and I have a very small experience on that subject except in regard to copper in peas. In one instance I found six grains to a pound.

2006. That is rather an important exception, is it not? —It is only one exception, but it is an important one, as the copper was present in rather an excessive quantity. Having regard to the point you very reasonably raised of taking small quantities for analysis, it is possible to over estimate, I think, the amount of copper per pound of peas, and in that case it would seem advisable for the whole pound to be examined so as to be able to state absolutely the amount in the pound.

2007. What was the amount that you detected?—It was calculated as equivalent to six grains of crystallised copper sulphate per pound of peas.

2008. What effect would that have upon the consumer? —I am not prepared to say, as I think that is rather a medical question.

2009. (*Professor Thorpe.*) How do you know that it was copper sulphate that was in the peas?—I have not stated anywhere that there is copper sulphate in the peas, but I have calculated the amount of copper found as crystallised copper sulphate. I do not believe the copper present is there as copper sulphate.

2010. In what form do you think it is?—I think it is a proteid compound.

2011. Is it soluble?—No.

2012. Is it ever likely to be soluble?—Under what conditions?

2013. Digestion?—Possibly, yes.

2014. Have you any idea how the copper is distributed in the pea?—No, I have no idea.

2015. Is it likely to be on the outer covering more than in the body of the pea?—I should think so.

2016. The copper, of course, is added to preserve the colour of the pea?—Yes, I believe so.

2017. Not simply as a preservative?—No. I have examined plenty of samples of tinned peas without copper in at all.

2018. You speak, I notice, rather guardedly about the use of copper; you say in your synopsis, "if it is to be recognised at all"; what is your opinion; should it be recognised at all?—The subject has not been cleared up from the physiological point of view. As to what the effect is of the copper proteid compound upon the organism, I do not think it is known with certainty, and until that is known I do not think it is advisable to lay down any precise pronouncement upon this question. If that be settled, then it seems to me that first of all will decide whether copper can be tolerated at all, and if so, the amount to be tolerated in this way. But this turns, it seems to me, on the question of the physiological action on peas so treated. I am not aware that that has been done with any definite conclusions.

2019. From the very nature of the process by which the peas are coloured, by a salt of copper, it is quite obvious that the amount of copper cannot be uniformly distributed through the mass of them?—I should not expect to find the amount of copper absolutely uniform.

2020. Does that not make a difficulty as to the application of a limit?—Probably it would introduce a difficulty.

2021. It would almost make it absolutely impossible to get a conviction, I should think?—Yes, if legislation is turned towards limiting the amount in this particular instance, *i.e.*, of colouring a solid. Of course, if it be turned simply on the question of the existence of the copper, there would be no difficulty.

2022. You say you would determine a limit?—Yes, quite so.

2023. It seems to me that it would be almost unworkable, even if a limit be adopted, and that in practice it would be almost impossible to get a conviction knowing the circumstances?—I am rather inclined to think the limit could be fixed if a sufficient quantity is examined; but this seems to me to rather suggest a line of experiment as to how the copper is distributed, which could easily be done.

2024. No doubt we could find in a particular portion of the pea where the copper was; there is no difficulty in that; my difficulty is to obtain a proper sample?—I may say that on this point, in examining peas I have always done the work in duplicate, and I have gone further than that, and had the advice of my colleagues, and the advantage of their analytical manipulation too. We have taken from one sample different portions in small amounts for the purpose of analysis, and we have all agreed as to the amount—so that looks rather like a uniform distribution of the copper.

2025. That, of course, would be in a comparatively small sample, would it not?—Yes.

2026. Would it not meet the case if the vendor of the pea were required to state that it was coloured with copper?—I think it would certainly if its addition is decided as objectionable.

2027. Then it would not be necessary to call upon anybody to fix the limit?—If that is so there would be no necessity to call for any question of limit at all.

2028. Of course, the mere fact of the presence alone would be sufficient?—Quite. It seems to me however a very important assumption that the copper is not evenly distributed, because, obviously, if there be unevenness one may get a very large dose of copper in a portion of peas. I think it is rather my evidence that in the examinations I have made, where three or four of us have taken portions of the same sample, our results have been the same, and that that points to the uniform distribution of the copper. That, if I remember rightly, prompted me to suggest that some limit could be placed upon the amount of copper salt employed. I think you will find that so in other experimental evidence. I am only trusting to memory, but I think in cases that have been referred to other analysts, you will find that the amount of copper has generally been confirmed in a case where they are dealing with another portion of the sample; and that looks like uniform distribution of the copper used.

2029. Of course, the greater number of such cases must come or have come really through reference under the Sale of Food and Drugs Act?—Quite so.

2030. (*Chairman.*) You state that numerous samples of peas have passed through your hands uncoloured with copper?—Yes.

2031. Were they of a bright colour?—No, they were of an inferior colour compared with the others.

2032. They were off colour?—They were of very inferior colour indeed, such, as I say, would not appeal to the public in a general way; they were quite off colour.

2033. But not inferior in any other respect?—I did not carry out the experiments so far as to taste the peas or cook them, and so on; so I cannot say anything on the question of the flavour.

2034. (*Dr. Tunnicliffe.*) May I ask what colour the peas were?—Those not treated?

2035. Yes?—They were more on the side of yellow than on that of green.

2036. (*Professor Thorpe.*) I suppose one reason why quantitative estimations of boracic acid are not made in such small quantities as they occur in milk or butter is on account of the difficulties of quantitative estimation?—Yes, I believe there is a difficulty. I have had some experience of the estimation of boracic acid, and it is a difficult process, though, I believe, accurate.

2037. You have had a number of these preservatives no doubt through your hands, or you have had a number of foods containing them; are you in a position to tell the committee anything as to the relative use of them, I mean which are used in the largest extent of all the preservatives you have named here?—Either boracic acid or borax.

2038. Then which would you put next?—Salicylic acid.

2039. And then next?—Benzoic acid.

2040. And formaldehyde would be the last?—I beg your pardon, I would put formaldehyde before benzoic acid.

2041. Is the use of formaldehyde increasing?—I think so.

2042. Is the use of salicylic acid increasing?—No, I do not think so from my experience.

2043. Have you found many samples of food containing benzoic acid?—Very few.

2044. Have you had a sample of food through your hands which contained fluorides?—No.

2045. Do you know that fluorides are used now as antiseptics?—Yes, I have heard so; but I have not met with them.

2046. You state in your synopsis that benzoic and formaldehyde should be prohibited altogether. Why?—In the case of the formaldehyde, I believe—this is rather, of course, based on what I have heard from medical men, colleagues on the staff—that formaldehyde exercises some profound influence in the case of nitrogenous food upon the proteid matters rendering it indigestible. In the case of benzoic acid the presence of that acid certainly in the case of invalid foods, and possibly ordinary foods, might be objectionable on the score of increasing the acidity of the urine, and possibly setting up irritation in the urinary tract—it gives, as you know, hippuric acid.

2047. I gather that you would allow the use of preservatives at certain seasons especially?—Yes, distinctly.

2048. At what seasons?—In the summer.

2049. And in what substances?—Milk chiefly, butter and cream; in fact milk products.

2050. If so, how would you guard against the pernicious use of boracic acid in those things, milk especially?—Only by prescribing by Statute the maximum quantity allowable. First of all I should suggest that the foods that are perishable should be scheduled, and then I should schedule the preservatives allowable to be added to these in a definite prescribed quantity; that is to say, giving a maximum.

2051. That maximum, of course, would have to be such as to preserve the food?—Quite so.

2052. It might happen in the case of milk that the amount taken by an infant would very rapidly reach a medicinal dose?—Yes, it might; but, as I have already suggested, there should be a clause that the purchaser should be able to demand a preservative-free article. I have also stated that I think in any case the presence of a preservative should be notified.

2053. Would that not suffice for the purposes of the Legislature on account of the difficulty of determining the amount of the boracic acid, and the conflict of testimony which would inevitably arise; would it not suffice for practical purposes that the fact that the preservative used should be notified by a label or in some other way?—Do you mean that it may be added in any amount which the seller may choose to put in?

2054. At present it is added in any amount that the seller may choose to put in, is it not?—Yes.

2055. In that respect I think experience shows that the public takes care of itself in so far that it detects an undue amount?—Quite so.

2056. But what the public wishes to know, of course, is whether it is purchasing something containing the boracic acid?—Quite so. But then the question turns on what is an undue amount it seems to me in that case. I have already stated what I consider to be an important point in this inquiry, namely, that there is a limit to the antiseptic power of preservatives, and that there is a limit to the antiseptic power of borax.

2057. But that practically must depend upon the season of the year?—It would largely, but I do not think the variations would be very wide.

2058. But do you not see practical inconveniences in putting down a limit, I mean looking at it from the point of view of working any enactment in which such limits were contained?—If it is decided that the action of boracic acid is injurious, I think it is essential that a maximum limit should be insisted upon.

2059. You have given it as your opinion that it would be desirable that a schedule should be drawn up of foods which are deemed to be perishable, and in which the addition of a preservative may be allowed?—Yes.

2060. Have you thought over what machinery would be required to give effect to that?—I think that we have as bearing upon this the evidence of some experience as to the foods which require, especially in the season I have referred to—in the summer—the addition of preservatives. It seems almost impracticable then to carry milk about without the addition of a preservative. That is the sort of thing I am referring to—perishable foods, in a word. Then I have also referred to the experience I have gained by samples sent to the "Lancet" of articles of food which had no indication of containing preservatives; clearly if that can be done I should exempt those from any schedule.

Mr. S. A. Vasey.

22 Nov. 1899.

2061. What authority is in your mind to draw up a schedule; who is to do it?—I would take that as a subject which the Committee would consider.

2062. Then if such a schedule were drawn up, what machinery are you thinking of that from time to time could add to it, because it would be continually undergoing alteration or addition?—I do not myself see any difficulty about adding that to the present Food and Drugs Act, or at least to the Food and Drugs Act, 1900.

2063. But you would vest in the Local Government Board or in the Board of Agriculture, as the case may be, the power to determine whether an article of food was perishable, and when preservatives might be added to it?—To lay that down first, and then schedule that food as a perishable food, and one which may be preserved with a preservative within limits also laid down by statute.

2064. Of course, this is a detail, but then I do not quite understand how this is going to work. Should it be an offence under the Food and Drugs Act to have found a food which has not been decreed perishable, and which should contain preservatives?—Yes, in view of the fact that foods are found which do not require the addition of preservatives.

2065. (*Dr. Bulstrode.*) I understand you to say, in answer to Professor Thorpe, that the public protects itself against the addition of preservatives?—Professor Thorpe stated that, I think.

2066. I rather thought you agreed with him?—No, I do not think so, except possibly as to undue amounts.

2067. Suppose it were impracticable to label the amount of preservative—speaking now of boracic acid in milk—would you say that is a reason for prohibiting the use of boracic acid at all in milk?—If it were found impracticable to do what?

2068. To label the amount?—I never suggested that the amount should be notified, but only that the preservative is present.

2069. Do you think that would be sufficient to protect the public health?—Yes.

2070. We have had it in evidence before us that there are certain conditions, notably of the kidneys, which contra-indicate the administration of boracic acid, and that there are other conditions which also contra-indicate its administration; we have also had it in evidence that there is found in milk at times a far larger amount of boracic acid than is prescribed by the Pharmacopœia; if those statements are true, then there are a large number of people living who are in such a state of health that the administration of boracic acid is relatively dangerous to them; would that fact modify your position at all?—Let me understand the question.

2071. We have had it in evidence that there are certain morbid conditions of the human economy which contra-indicate the medicinal administration of boracic acid; one witness told us that he would not administer boracic acid to any person with a diseased kidney, and that furthermore he would not admnister it to anyone with a condition he described, I think, as atonic dyspepsia; it is also stated in books on therapeutics that it is thought boracic acid may have an influence upon the contractile fibres of the uterus. Accepting those as facts for the moment, would you still think that the mere notification of a preservative, or of the nature of the preservative being in a food, would be sufficient to protect the public health?—No, I do not think it would; it rests then with the purchasers, it seems to me.

2072. Then, in order to protect the public health, would it be necessary that the purchaser should be in the possession of knowledge which taught him what was not good for him?—That is so.

2073. That would mean that every woman about to bear a child should know that boracic acid was not good for her?—Yes, instructed by her medical attendant.

Mr. S. A. Vasey.

22 Nov 1899.

2074. And it would also mean that everybody with disease of the kidney knew that he had disease of the kidney?—Yes, quite so.

2075. Would that modify your position at all?—What do you mean by my position; what is the particular position you refer to?

2076. I rather understood your position to be that, on the whole, you would advocate that it was not necessary to state the amount of preservative used?—I stated that the preservative should be specified in the statute, with the maximum quantity permitted to be used.

2077-78. Do you think from your own experimental work that the maximum quantity found necessary to preserve milk in hot weather—or the minimum quantity would be such that it would not be detrimental to children taking, say, two pints of milk a day?—I should not like to state that; I think it is more a medical question than a chemical one. I have already said that the purchaser should be able to demand an article free from preservatives.

2079. To pass to another question; the "Lancet" has, I think, for the last half century devoted very considerable attention to this question of food adulteration and its mollification?—That is so.

2080. Since the "Lancet" Sanitary Commission of 1850?—That is so.

2081. You are probably generally familiar with the literature contained in the "Lancet" from that time?—Yes, I am.

2082. Could you tell the Committee at what date, according to the literature of the "Lancet," boracic acid as a preservative was introduced and began to be used?—I cannot give that without reference to the file of the "Lancet." I have that particular work of the "Lancet" that you refer to summarised, so I daresay I could put my finger on that, but I am not prepared to give you a date of that sort now.

2083. Do you think that by looking into that question you could report to the Committee at what dates the several preservatives now in common use appeared upon the stage?—Yes. That is a matter of history I take it.

2084. I think it is?—I think I could furnish to the Committee that information, but I am not prepared with that now. I have got access, of course, to the "Lancet" from the time the "Lancet" commenced, and I have no doubt that I could put my finger upon the matter dealing with that.

2085. (*Chairman.*) If it is not giving you too much trouble, we should be very much obliged if you would kindly do so?—I should be very glad to furnish information of that sort to the Committee.

2086. (*Dr. Bulstrode.*) Now, with regard to the nature of the copper in peas, do you agree with this: "In green vegetables copper probably exists as an insoluble leguminate from which the metal is liberated and rendered soluble by the action of the gastric and pancreatic digestion?" Do you think that is probable?—I think that is probable.

2087. In other words, the copper has become soluble in the human economy?—Quite so.

2088. You are also aware that in Germany, Austria, Belgium, Spain, Russia, and most of the Swiss Cantons the use of copper as a colouring matter is prohibited?—I am only aware that it is so in France, not in the other countries.

2089. Are you aware that in France the prohibition has been withdrawn?—Yes, I am also aware of that recently—I think four years ago.

2090. Do you know in Italy that one gramme* of metallic copper per kilo of peas is allowed?—No, I do not know that.

2091. Would you think that a dangerous amount—one gramme per kilo?—Is that sulphate of copper?

2092. It is metallic copper?—I should like to put that in strictly comparable terms.

2093. (*Dr. Tunnicliffe.*) I think it would mean 7½ grains of metallic copper to the lb. approximately?—I should think that a dangerous addition.

2094. (*Dr. Bulstrode.*) Do you know that the New York Board of Health allows green peas to be sold that contain not more than three-quarter grains of metallic copper, equal, according to this book, to three grains of crystallised sulphate per lb., provided the label of each tin contains a statement to that effect?—I was not aware of that.

2095. Do you see any objection to that practice being adopted in this country?—No, inasmuch as it announces the fact that copper is used.

2096. And the amount of it?—And the amount, yes.

2097. Do you know the largest amount of copper which has been found in a lb. of peas?—No, I do not know the largest amount, but the instance I gave, six grains to the lb., I think exceeds that commonly found.

2098. Do you know there is a case on record in which 26 grains were found?—I do not remember that, although I may have seen it.

2099. You have stated that the "Lancet" had specimens of milk from several public establishments?—Yes, from hospitals.

2100. Was any obtained from the fever hospitals of the Asylums Board?—No, they were the general hospitals.

2101. The "Lancet" about a year ago undertook an inquiry by means of sending out questions to medical men and physiologists—selected men—asking them their opinion with regard to the use of preservatives?—That is so.

2102. In a paper which appeared in the "Lancet" about a week ago—perhaps more than that—by Dr. Annett, he says, referring to these opinions, that they were unanimously of the opinion that the use of antiseptics in foods was injurious to health, but that they could produce no direct evidence in support of their opinion?—I believe that is a correct summary of the evidence.

2103. You also would summarise the evidence in those terms?—Yes.

2104. You would not summarise the evidence by saying that the preponderance of it was that the nature of the preservatives should be labelled?—Would you mind again reading that summary by Dr. Annett?

2105. There is the paper (*handing in a copy of the "Lancet" to the witness*)?—This is in quite a recent number of the "Lancet," which has appeared since the sittings of this Committee began. I think you put the question a little outside that. I think this is quite true, that the opinions of the medical men who subscribe their opinions in the "Lancet" in the number you refer to, to the effect that the use of antiseptics in food is injurious to health is correct, and also that it was an opinion that was not supported by any evidence of experience.

2106. Why I asked that question was because I have read this through very carefully, and the conclusion I rather came to was that the opinions which, as you say, were not founded upon evidence seemed rather to indicate that at any rate in the first instance labelling would meet the ctse?—Yes, that is so; but this inquiry does not so much refer to the question of legislation as to the question of injury to health. I can promise the Committee that I will do my best to furnish them with the information during the next few days. (*See App. No. 10.*)

2107. (*Chairman.*) We shall be greatly obliged to you. Does anything else occur to you that you would like to bring before us?—I think not. I have given you all my views, I think, on the subject.

This is unfortunately an error on my part. It should have been 0·1 gramme. This fact obviously modifies very materially the statement made in the three following paragraphs, 2091–93.—*H. T. B.*

EIGHTH DAY.

Thursday, 23rd November, 1899.

PRESENT :

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Dr. WILLIAM WILLIAMS, called ; and Examined.

Williams.
23 Nov. 1899.

2108. (*Chairman.*) You hold, I think, the following degrees in the University of Oxford :—Master of Arts, Doctor of Medicine, Bachelor of Surgery, and you are a Diplomate of Public Health ?—Yes.

2109. You are a Member of the Royal College of Surgeons of England, a Fellow of the Chemical Society, Fellow and Examiner of the Sanitary Institute of London, Ex-President of the West of England and South Wales Branch of the Incorporated Society of Medical Officers of Health, President of the Sanitary Inspectors' Association of South Wales and Monmouthshire, and Medical Officer of Health to the Glamorgan County Council ?—Yes.

2110. Do you appear on behalf of the Incorporated Society of Medical Officers of Health ?—I do, and at the request of this Committee.

2111. I think you will be able to tell us something about the action taken by the Glamorgan County Council as regards preservatives and also colouring matters ?—Yes, the Glamorganshire County Council have taken considerable action in regard to boric preservatives especially in milk, butter, and other articles.

2112. Perhaps you can tell us how you have dealt with boric acid and borax ?—Boric preservatives are the only preservatives that we have dealt with. For some years we have noticed from the result of analyses that boric acid preservatives were frequently and in large quantities, added to milk and butter in particular. The subject was on many occasions fully discussed by the Local Government Committee of the County Council, with the result that in 1896 they asked me to prepare a short report. This I did. The report was as follows :—"Boric acid and borax in milk, butter, etc. The present state of our knowledge of the physiological action of boric acid and borax is so imperfect that it is difficult to say what amount of these substances, if any, can be added with safety to consumers, to articles of food such as milk, butter, etc. It appears from Kobert's 'Intoxication' that cases of slight poisoning have frequently occurred, and occasionally death. The symptoms appear to be due to irritation of the gastro-intestinal canal, decomposition of the blood, and irritation of the nervous system. Large doses appear to cause diarrhœa, wasting, weakness of the muscles, and of the heart, and purpura on the skin. Several authors have said that 40 to 60 grains of borax might be taken for several months without causing any disagreeable symptoms ; but other observers saw symptoms of poisoning from these doses in man in the course of a few days. It was the opinion of Sir Andrew Clarke and others, that many diseases, the origin of which doctors were unable to trace, were attributable to the use of these and other antiseptics. It may be said, and with truth, that the addition of borax or boric acid, will tend to prevent the formation in milk of the poisons which may be produced by bacterial decomposition. But at the same time, if dairymen are allowed to add boric acid or borax at their own free will, they will be under the temptation of keeping milk longer than they would otherwise do, and thus the public will in the end run the double danger of boric acid plus decomposing milk. The use of boric acid in milk is entirely prohibited in France, and some of the largest milk supply companies in the Metropolis entirely forbid it, thus showing that there is no absolute necessity for its use. At Birmingham convictions have been obtained for boric acid in milk to the extent of 60 to 65 grains per gallon. It seems to me that borax and boric acid should not be sanctioned as preservatives to milk, butter, etc., unless very stringent rules indeed are passed as to the quantity to be used, and in the present state of our knowledge regarding these substances it would probably be better to prohibit their use altogether, for there can be no doubt that the principle is utterly bad, and the practice of drugging the public promiscuously, and without their knowledge, and by incompetent persons, when they are in good health is very dangerous."

2113. Where did you take the samples on which your analysis was made ?—We took them from different vendors of milk in streets, shops, and in other places Of course, the butter was bought in shops in various parts of the county.

2114. In various towns ?—Yes, and country districts. For the purposes of the Sale of Food and Drugs Act the county is divided into five divisions, and samples were taken in each of those five divisions.

2115. Do you know where the preservative was added —was it added at the farm, or on the milk vendor's premises ?—I could not say that. On one occasion I did not actually see the preservative added ; but the milk seller at the farm told me that he had just added it, and he showed me what it was.

2116. What was the maximum proportion that you found, first in milk ?—I have given the figure in each instance in my synopsis. On examining the figures it would seem that the amount of boric acid added varied from 0·019 per cent. to 0·3 per cent., which is equivalent to 13½ grains to 210 grains per gallon respectively ; so that the highest we came across in milk was 210 grains per gallon, and the smallest 13½ grains per gallon.

2117. 210 grains per gallon I suppose is far more than is necessary to preserve milk ?—Far more.

2118. Do you suppose that was an accidental quantity ? —We have taken a large number of analyses, and I have got the highest figure here. In one year we took 332 ; in the next year we took 379 ; and, in the present year up to the time I wrote my synopsis, we had taken 265 samples. The highest quantity found was 210 grains per gallon ; the next was 140, and the one after that 56 grains per gallon ; so that 210 grains was by far the highest quantity ; 140 grains is very high, too.

2119. Do you think there is any precise method on the part of the milk vendors or farmers as to the addition of these preservatives ?—No, on the contrary, I am sure there is not, from the result of my observations.

2120. Do you think that it is possible that sometimes the farmer might add borax, and also the vendor might do so ?—I think so. There is no rule observed ; that is quite evident to me from these figures.

2121. Do you consider 210 grains per gallon an excessive quantity ?—I think it is very excessive.

2122. Do you consider it would be injurious to the human consumers ?—I should not like to give milk containing any boracic acid to any child or to any invalid, to say the least.

2123. Children and invalids, of course, are the principal consumers ?—Certainly.

2124. What effect has cooking upon boracic acid ?—It would not be in any way affected I think, by the cooking.

2125. It would remain in boiled milk as active and as efficient as in raw milk ?—Yes, I think so. Then we have taken many samples of butter. In 1897 we took 82 samples ; in 1898 we took 123 samples ; and in the current year, up to the time I was writing this synopsis, about a month ago, we

Dr. W. Williams.

23 Nov. 1899.

had taken 83 samples. In the first year we found 45·1 per cent. contained boric acid; and in the present year up to the time I was writing, 26·5 per cent. The amount of boric acid that we found in butter varied from 0·015 per cent. to 1·6 per cent.—that is to say, from one grain per lb. to 112 grains per lb.

2125*. Can you tell us whether that was principally imported butter, or butter made in the district?—It was principally imported, no doubt, because in the mining districts of Glamorganshire there is very little butter made. In the Vale of Glamorgan, of course, there is a very considerable quantity made, but I should say it is mostly imported butter throughout the district.

2126. In the present year 73·5 per cent. of the samples which you have examined were free from preservatives, as I understand?—73·5 per cent. in this present year did not contain boric preservatives; of course, the year before and the year before that the percentage is different.

2127. I was talking of the present year. Were these samples all of fresh butter?—No, I should say certainly not; I could not say what the butter was.

2128. What I mean is, was it a salted butter?—Yes, some of the butters contained salt, without doubt.

2129. What steps did your County Council take on receiving your report?—In December, 1896, they adopted my report, and the matter was discussed then and before very thoroughly. With respect to milk the Committee recommended that the use of boric acid and other analogous preservatives be entirely prohibited, and that handbills containing a notice to that effect be printed and circulated to milk vendors throughout the administrative county. That is as regards boric acid in milk. With respect to butter, it was recommended that in all cases where the admixture of boric acid with butter exceeded 0·5 per cent., that is 35 grains per lb., which was double what the Committee was advised was sufficient as a preservative, that prosecutions be instituted. The County Council came to the conclusion that so far as milk was concerned no chemical preservatives whatever were to be added, and as far as butter was concerned they would for the present allow twice the amount which they were advised was sufficient to preserve it—that is to say, 0·5 per cent., or 35 grains per lb. They were advised that 17 grains per lb. was quite enough to preserve butter for a reasonable time. This is how the Glamorgan County Council is at present situated with respect to the question, and in June last the Clerk to the Council was given discretion as to authorising proceedings against sellers of articles of food adulterated with preservatives, pending the decision of this Committee on the subject. I have prepared and sent in tables giving particulars of all the samples that were taken, and the results, and so on, and at the end I have given another table, showing the legal proceedings. (*See Appendices Nos. 23 and 14.*)

2130. Have any convictions been obtained?—Yes.

2131. Can you tell us the number of cases in which proceedings have been taken and convictions obtained?—There were five milk cases.

2132. (*Professor Thorpe.*) Ranging over from 1897?—Ranging over from July, 1897, to August 31st, 1899. I have no record after that date. On each occasion, with the exception of once, when the case was withdrawn, the seller was fined. In the one case he was fined 40s. and costs, the costs being £6 14s.; in the second case 40s. and £1 8s. costs; in the third case £2, and in the fourth he was ordered to pay the costs—£1 11s. 6d. As I have said, the other was withdrawn.

2133. I notice that the first two prosecutions were taken under a different section of the Act to the others. Why was it necessary to vary the section under which this prosecution was instituted?—When we began to take proceedings they were taken under Section 3; but we soon found out that this was not the section to go under, and we at once changed to Section 6. Under Section 3 we are bound to prove injury to health, and I told the Council that I was not in a position to prove such injury, and we went afterwards always under Section 6, alleging that the substance was not of the quality, and so on, demanded.

2134. "The nature, substance, or quality"?—Yes, that is it. We have gone under that section since which, no doubt, is the right one for us to go under, I think.

2135. (*Chairman.*) Do I understand that proceedings were taken in respect of butter?—Yes, we took proceedings in respect of butter in fourteen cases.

2136. And did convictions follow?—Yes, we had several convictions. Some cases were withdrawn, and some were dismissed. I have given the reasons in the table why they were dismissed. In one case it was because exception was taken to the form of the analyst's certificate; in another one it was the same; in another one it was adjourned, and subsequently withdrawn, exception being taken to the form of certificate; then there was the same thing in the next two cases; in the next case after that there was a technical error of the day in the summons. We took action once under the 27th Section of the Act, and here it was a question of false warranty. I do not know whether you want to go into this, but in that case there was also the fact that the butter contained a small quantity of boric acid. The remark I have there is: "No proof before court that warranty given by defendant as forming original contract." This I had nothing to do with, but I thought I would include it, because it did contain boric acid.

2137. Then, judging from the figures you put before us, the prosecutions have not had the effect of stopping the use of preservatives?—I think that they have had that effect, decidedly.

2138. They have diminished the cases, but they have not stopped them altogether?—No, it will take a long time to do that. I think you will find on referring to the first table I have given, and the fifth column, which shows the percentage of samples containing boric acid, that in 1897 we found 3·3 per cent.; in the following year 0·8 per cent., which is a great reduction; and in the current year up to date 1·1 per cent., and I suppose by the end of the year this will be less again. That is, as far as milk is concerned. With regard to butter, in 1897 we found a percentage of samples containing boric acid of 45·1; in 1898 it was 34·1; and in the present year, up to date, it is 26·5; so I think it must have had some effect.

2139. Can you detect the presence of boric acid in butter or milk by taste or smell?—No, I do not think so; it is nearly tasteless, and that is why they add it mostly, I think.

2140. You advocate, I understand, a notification in every case of a preservative?—What I advocate is this: that no boric acid or other chemical preservative should be added to milk under any consideration, and only to butter in the minimum quantity desired to preserve it, and if this minimum quantity is added then its nature and quantity should be made known to the purchaser.

2141. (*Professor Thorpe.*) Have you noticed that the amount of boric acid, or the prevalence of its addition varies with the season of the year?—Yes, that is so.

2142. In what seasons is it most frequently added?—In the hottest season of the year. That would be the third quarter of the year, I should think, generally. We have been in the habit of taking more samples of milk then than at any other time.

2143. Then those samples that you quote have not been distributed fairly uniformly over the year?—No, we have always taken more in the hottest quarter of the year, because judging from our previous experience we found out that it was most prevalent in that time.

2144. In this particular year, which has been a remarkably hot summer, you ought to have found, I suppose, a larger proportion of samples containing boracic acid as compared with previous summers?—Yes.

2145. Have you done so?—We did not find that was so, and I take it the reason is this—because we have been taking proceedings against the people for putting it in. This year, up to the time I was writing, about a month ago, we found three out of 265 samples containing it.

2146. Have you any knowledge as a medical man of any injury to health resulting from the use of preservatives?—No, I have not.

2147. Would you be of opinion that the community would be sufficiently protected if it were notified to the consumer that a particular article of food contained preservatives?—That would not be a safe protection, for the simple reason that many of the consumers, at any rate, would not understand it. Of course, it would give them a chance.

2148. Of course, we may conceive a condition of things where a limited use of preservatives would really be beneficial, on the whole, to a community, and in a great number of cases, provided the preservative were below the minimum quantity, no considerable amount of injury would be done. What I am driving at is this, that the effect of stopping the use of preservatives to any dairy

Dr. W. Williams.

23 Nov. 1899.

produce would be to considerably curtail the supply of certain articles of food?—Yes, it would, I should say.

2149. Nevertheless, in exceptional circumstances, these preservatives might be injurious to a person?—Certainly.

2150. Either he might be constitutionally indisposed towards them, or he might be at the time suffering from some illness, which precluded the use of them?—Certainly.

2151. But those, of course, may be exceptional conditions?—I suppose so. Only, of course, one has to bear in mind that milk is the diet of children, and that milk is the principal diet of invalids. Of course, children form a large percentage of the community, and it is very important that they should be properly fed.

2152. I mean if safeguards in the way of labelling and indicating at the time of sale that the substance contained preservative were insisted upon and could be enforced?—Do you refer to milk now, may I ask, or do you refer to butter, or any other article of food?

2153. I was referring at the moment to all dairy products, milk and butter; if the public were sufficiently made aware of the existence of preservatives in any article of food that they were contemplating purchasing, do you not think that, at all events, in a short period of time it would be generally known to mothers that boracic acid in milk was not good for them?—A good many mothers would know it, no doubt, but I do not think by any means all of them would.

2154. If your own county council took the action of posting handbills?—They did that to all milk vendors.

2155. But if they took the precaution of posting handbills to warn mothers against the use of boracic acid?—They might do that. Whether it would be within their jurisdiction or not I cannot say exactly at this moment; but if they did it, it might do some good.

2156. It would be equally within their jurisdiction to do it, as to do what they have done?—It would be more difficult a great deal.

2157. Why?—Because we got the several inspectors under the Sale of Food and Drugs Act to deliver them in all the shops in their districts that sell milk and butter. It would be a very difficult matter indeed, and we would have to increase our inspectors considerably, I should say, if they had to distribute a handbill to each mother.

2158. You could merely post that up?—Merely to post up a public notice I do not think would do so much good, because not one-half—not one-fourth—of these mothers would ever read them, especially in our colliery districts.

2159. Would it not become a matter of public notoriety; would it not be conveyed from household to household?—It might be to a certain extent; but some of the mothers in our colliery districts are very careless.

2160. Of course, you are aware that such an action is not without precedent?—I did not know myself that handbills had been distributed to mothers.

2161. Not so much with regard to the presence of boracic acid in milk, as to the danger of using condensed and separated milk?—I am aware of handbills to that effect have been circulated.

2162. Public notices?—Yes, I am aware that public notices have been issued.

2163. Would it not be equally possible to do something similar in the case of milk containing boracic acid?—Yes, it would be possible to do an exactly similar thing; but my opinion is that not one-fourth of the mothers in Glamorgan would take the slightest notice of it; that is my opinion, judging from what I know of them.

2164. (*Dr. Tunnicliffe.*) What do you regard as the position of a medical man in this subject?—A medical practitioner?

2165. Yes; I mean as an adviser to the public?—I do not quite follow you.

2166. What I mean to say is this: Do you not think if the means were adopted such as Professor Thorpe has suggested that if at any rate it did not reach absolutely each mother it would reach each medical man?—It would be sure to reach each medical man, I should say.

2167. Under those circumstances do you not think that in any case, we will say, of obstinate diarrhœa, he could advise the mother with regard to boracic acid?—Yes, most decidedly.

2168. And therefore it would to some extent do good?—And to a great extent I think it would do good.

2169. Having in view the position of the medical man in this matter, do you still think that labelling milk as containing boracic acid would be ineffectual, or would you object to the use of preservatives under those circumstances in milk?—In milk, I would object to it altogether.

2170. In spite of the position of the medical man?—Yes, decidedly, because I think that milk can be kept long enough provided there is due regard to cleanliness, etc., without any preservative at all.

2171. Would any prolonged and considerable epidemic of diarrhœa come under your jurisdiction, so to speak?—Yes, to a certain extent, you know, I get advised. I get notified to me from every district in the county—and there are thirty of them—every week the number of infectious diseases, and of diarrhœa, too, to a certain extent.

2172. Have you ever had it suggested to you by the medical man in whose practice such an epidemic occurred, or such a set of cases occurred, that it was due to boracic acid?—I have heard it suggested, by a medical man, that the permanence of diarrhœa amongst the children in his district was, in his opinion, due greatly to preservatives in milk. I have heard that.

2173. You have heard that?—Yes. I could not prove it, of course, myself. It would be very difficult for me to know, you see, what milk they were taking.

2174. That is the question I wanted to have answered; you have had it suggested to you?—Yes.

2175. But you have never had any case brought under your notice by a medical man?—Not any particular case.

2176. Nor a set of cases?—No, nor a set of cases.

2177. You do not speak with, so to speak, any authority with regard to the action of boracic acid?—No, I could not do that, because I am a medical officer of Health, and I have had no experience of private practice you see; therefore, I could not do that.

2178. You throw the responsibility of your statement upon Professor Kobert, and you quote Professor Kobert in your report?—Yes, in that report I do.

2179. Your recommendation seems to rest a good deal upon what you quote from Professor Kobert?—Yes; but, to some extent I give it from my knowledge, and from my observation that no chemical preservative, nor any other preservative, as far as milk is concerned, is required.

2180. That is hardly the point we are entering into now—whether it is necessary or not—we are dealing with the point of its being injurious to health?—Quite so.

2181. In so far as it concerns that, the responsibility for the bulk of your recommendations rests with Professor Kobert I take it?—Yes, and other authorities.

2182. There is a question I should like to ask your opinion about before the Committee, and that is this. Is boracic acid more frequently added to milk which is, to a certain extent—not grossly, but to a certain extent, decomposed?—My opinion is that it is so.

2183. Supposing ill results were to follow the administration of such a sample of milk, would it, in your opinion, be difficult, or easy to ascertain whether the symptoms were due to the preservative or due to the substance of decomposition?—Most difficult, I should think.

2184. It would practically be impossible?—I should say so.

2185. Therefore, in the case of milk containing preservatives in the hot part of the year, even should ill results occur, it by no means follows that they are due to the boracic acid?—It does not follow exactly, of course, unless you could find out that the boracic acid was added immediately it left the cow, which I have no doubt is frequently the case.

2186. That is to say, before any decomposition has begun?—Yes.

2187. (*Chairman.*) You differ then from Dr. Robert Bell, of Glasgow, who gave evidence in one of your cases in Glamorganshire, and who gives it as his opinion that once decomposition had commenced boracic acid could not undo it?—No, not exactly. What I do say is this, that milk which is just beginning to turn sour, when you add boracic acid to it, seems to become sweeter as it were; but I do not think it actually does do so. I do not exactly differ from Dr. Bell in that way. I do not suppose it would do away with the sourness.

2188. (*Professor Thorpe.*) When you say boracic acid, do you mean what are called boric preservatives?—Yes, I do; I ought to have said boric preservatives.

Dr. W. Williams.

23 Nov. 1899.

2189. As you have said, the addition of a boric preservative would at all events neutralise by the soda which was present in the borax, the lactic acid which was being formed in the milk, and to that extent the milk would not be soured, but the sourness of the milk would have disappeared, and so the milk to that extent would be a little sweeter?—There is no doubt of that, because I have often found it.

2190. It was necessary to say that, because you said boracic acid itself would not have that effect?—I should have said borax and boric acid mixed, as a matter of fact we never come across any of this boric acid by itself, but always a mixture of borax and boric acid.

2191. (*Dr. Tunnicliffe.*) I was not referring to lactic acid in my question about diarrhœa, but was referring to bodies of the nature of ptomaines?—I understood you did so.

2191*. You understood that?—Yes, I understood that.

2192. Have you had in your experience as a medical man any series of cases of diarrhœa due to ptomaine poisoning in milk apart from all questions of preservative?—No, I have not.

2193. The ptomaines have been found mostly in meat, I suppose? You have had, I take it, food poisoning cases?—They do not come under my notice. Of course, I know that a few have taken place in some of the districts, but they did not come under my notice.

2194. You know of no series of cases either directly or indirectly of ptomaine poisoning from milk?—No, I do not.

2195. It seems that the effects of the administration of boric acid as a drug are out of all proportion to the effects of boric acid if administered as a preservative; I mean nearly all the cases of poisoning due to boric acid that we have had, have been in cases in which it has been used as a drug, and there is clear evidence before the Committee that in certain doses it is poisonous in its results?—That is so no doubt.

2196. But there seems to be by no means the same amount of evidence that it is injurious as a preservative; can you explain that in any way apart from quantity?—I do not quite follow you.

2197. What I mean to say is that nearly all the evidence that has been before the Committee with regard to the question of poisoning, due to boracic acid, has been when it has been used as a medicine, or has been used experimentally by itself; can you explain the fact that although milk and butter have been boracised such a long time there have been no injurious effects definitely established?—Yes, I think so. In the cases where injurious effects have followed, it was used as a drug, as you say, and no doubt it was administered by a medical man; but in the other cases it would be administered not by a medical man, but, of course, by anybody else, who would not be able to observe accurately. I think that would account for it to some extent.

2198. You think this would be to some extent accounted for by failure of observation?—I should certainly say so; one medical man told me the other day: "I am giving so many grains to a patient of mine now, and I mean to watch him very carefully." That is what he said. When a person in health takes it in milk there is nobody to watch him.

2199. You are aware, of course, of the fact that, as a general principle, when drugs are given on an empty stomach, that is to say, not with food, they are much more active than when they are given with food?—Yes.

2200. And do you think that would explain in any way the disproportionate effect between the action of boracic acid as a preservative and the action of boracic acid when given experimentally, or as a drug?—It might to some extent.

2201. You do not think the boric acid would be fixed in a sense by the bacilli, producing decomposition, and thus be innocuous, to any extent?—I am afraid I did not follow you there again.

2202. If you add boracic acid to milk that is undergoing decomposition, a certain quantity of it will act on the bacilli or on the germs present?—Possibly.

2203. Do you, or do you not, think that that in itself will render the boracic acid when administered innocuous, or help to do so?—I should not like to give an answer to that, but I should say not.

2204. (*Dr. Bulstrode.*) Do you know what the dose of boracic acid is, as given in the British Pharmacopœia?—About five to fifteen grains, I believe.

2205. Five to fifteen, I think?—Five to fifteen is right, I believe.

2206. Your experience with regard to the amount of boracic acid in milk would tend to show that a much larger amount than that is liable to be given?—Yes.

2207. Your experience would show that in one case as much as 26 grains in a pint, or 210 grains in a gallon, was actually found?—Yes, that is so.

2208. So that in many cases there would be a large margin over the medicinal dose?—Yes.

2209. What would be the medicinal dose for a child?—I could not tell you, because it has been given to a child, but very infrequently, I should say.

2210. It is smaller than to an adult, is it not?—Yes.

2211. Therefore a very large number of children, according to this, would be taking much more than their pharmacopœial dose?—Yes, certainly.

2212. Now with regard to the labelling of the nature of the preservative in milk; would that, in your opinion, meet what may be the danger to people upon whom the administration of boracic acid is contra-indicated—would the labelling of simply the nature meet that danger?—I do not think that would be sufficient.

2213. We have been told by some witnesses, medical men, that in certain conditions the administration of even small doses of boracic acid is contra-indicated, as in disease of the kidney and in some conditions of the intestinal tract?—Yes.

2214. Suppose only the nature of the preservative were stated, the medical man attending the case would not know how much boracic acid was in the milk, and therefore he would not know where he was, as regards the exhibition or the avoidance of it?—Yes, I see that.

2215. Would that be a danger which you think ought to be provided against?—I certainly think it ought to be.

2216. Now, I presume that you, as a Medical Officer of Health, have made a study of infantile diarrhœa?—I have not in particular; I have not had the opportunities of observing it as I have had other diseases.

2217. Then we will not go into that. Have you found the amount of boracic acid in milk greater in Sunday milk than in week-day milk?—I could not tell you that. I see the force of the question very well, but I have no notes of the quantity found in milk taken on a Monday.

2218. You said in your report to the County Council that boracic acid in milk is entirely prohibited in France?—I believe that is so.

2219. Could you tell us the authority for that statement?—I believe I found it in the evidence of the Committee that sat on this subject before. Did I say in milk or in butter?

2220. In milk?—I know in butter that is the case. I believe that you cannot sell butter in France containing boric acid, but you can bring it to England to sell.

2221. Are you of opinion that the action taken by the Glamorganshire County Council has in any way prejudiced the interests of the dairy farmers in the district?—I do not think so.

2222. And the result of its action has been to reduce the amount of boracic acid used?—That is certainly the case. In 1897 we took 332 samples, and eleven only contained boric acid—that is, 3·3 per cent. In 1898 we took 379 samples; three contained boric acid which is equivalent to 0·8 per cent.; and in the nine months up to October this year we took 265 samples; three contained boric acid equivalent to 1·1 per cent.

2223. Then the result apparently, judging from those figures, has been good?—Yes, there has been a diminution, no doubt; and the same with butter.

2224. Did you ever hear it suggested that the autumnal diarrhœa in this country amongst infants has been kept up by the practice of adding preservatives to milk?—I have heard it said by a few people that they were of opinion that boric acid caused the diarrhœa, but I cannot go any farther than that.

2225. You have not been into it?—No, I have not.

2226. (*Chairman.*) In June, 1898, I believe you gave evidence in a case at Pontypridd where a grocer was charged with selling ham adulterated with boracic acid?—Yes; I have a copy of the report of the proceedings here.

Dr. W. Williams.

23 Nov. 1899.

2227. There are one or two points in that I should like to ask you about. I have it here reported in the "Grocer"; in that you are reported to have certified that the amount of boracic acid in the ham was 0·8 per cent., which would be 56 grains to the pound. I do not want to put words into your mouth which you have not used. Do you remember the case?—I remember the case, and I have a short report of it, which I have brought here with me. It was not 0·8, as a matter of fact; it was 0·6—that is the figure I have got before me. If it was 0·8 it would amount to the 56 grains.

2228. How did the boracic acid get into that ham?—In the curing of it, I should say.

2229. We have been unable to get any evidence of boracic acid curing?—We do find boracic acid in ham; people do use it for curing hams and bacon extensively. In this ham we found 0·6—that is the figure I have down—I am not exactly speaking from memory, but I think it was 0·6.

2230. What I want to know is whether you draw a clear distinction between boracic acid used in curing hams and dry borax used in packing them?—No, we do not. Of course, when we say boric acid we mean a boric preservative. The boric acid is estimated—it is so much boric acid or the equivalent thereof; that is what it means. It does not matter whether it is boric acid or sodium borate or whether it is boric acid altogether. I should say that it is a mixture of the two that you find most generally used.

2231. They are quite different substances, are they not, borax and boric acid?—One is the salt of the other, or the derivative of the other.

2232. Would ham cured with borax be laid in a solution of the acid, or what is the process of curing a ham?—I could not tell you how they do it; I have never been able to find out, though I have tried to get to know. I know that in the case of fish, for instance, and eggs, those things are inserted in a solution of a certain strength of the boric preservative.

2233. Pardon me, that is not curing them?—No, that is not curing them. Of course, I do not suppose you could cure a ham by simply dipping it in a solution of boric preservative.

2234. All through this case the ham is spoken of as cured in boracic acid?—I have not read that account, but I remember the case perfectly well. All that we alleged was that we found boracic acid in the ham; we could not enter into the question whether cured with boric acid alone by immersing in it, or whether cured in any other way. All we did say, and as I say I remember the case perfectly well, was that we had found 0·6 per cent. of boric acid, which is 42 grains per pound, in this ham. Of course, some of the witnesses said that a good deal of this boracic acid would come away in the boiling or in the process of cooking.

2235. Then we must take it that in this case there was no distinction drawn between hams packed in borax and boracic acid, and hams cured in those preservatives?—Yes, that is so. We simply took a sample of the ham, and on analysis it was found to contain 0·6 per cent. of boric acid. Whether that was given to it by immersing it in the acid, or whether it was used in preserving it in some other way, I could not tell you.

2236. Do you think that packing or laying the ham in dry borax would be sufficient to saturate the fat and muscle with borax or boracic acid?—No, I should not say so myself. Of course, I have no expert knowledge on the matter at all.

2237. Do you recollect what part of the ham the sample was taken from?—No; I remember it was a few slices, that is all.

2238. What I mean is——?—I know. I can see the force of your question quite well. I did not take it myself, but I think the inspector went into a shop and asked for so much of the ham, and he got it. That is all I can say. I could not tell you whether it was a part near the bone or near the outside or not, but I can conceive that that part nearest the bone would contain less.

2239. (*Dr. Bulstrode.*) With regard to the samples which are analysed for preservatives in the several years which you have given us, you tell us that the percentage of samples containing boric acid or preparations of boric acid decreased year by year.

2240. Can you tell us whether the specimens found in the food not to contain boric acid were tested for other preservatives?—No, I cannot.

2241. It is just possible that these samples which contained no boric acid may have contained formalin?—Yes, it is possible. It is quite possible, as you suggest, that formalin was added when they began to knock off the other.

2242. (*Dr. Tunnicliffe.*) In your opinion, given milk with a certain amount of decomposition not necessarily evident to the smell or taste, would that milk be better for the consumer with or without boracic acid added to it?—I really could not tell you.

2243. The reason I ask is, that I take it that in a large populous district, like Glamorganshire, in the hot months of the year if preservatives are prohibited milk would be sold which was not absolutely fresh, in any case amongst the poorer classes?—It would be sold, I take it, to some extent.

2244. Therefore it would be of interest to know if such milk would be worse for the consumer without boracic acid than with it?—That I could not answer.

2245. (*Professor Thorpe.*) Are there any circumstances that occur to you in a large city like London, and especially in the poorer parts of it, which would make the conditions so different as compared with a place like Cardiff that the absolute restriction of boric acid might be difficult?—Do you refer to milk?

2246. What is in my mind is milk?—When I was going through this matter I wrote to several milk purveyors all round the country, and amongst them milk purveyors in London. I mention that somewhere in my synopsis.

2247. Yes, and I have read that; may I ask you what large milk vendors you wrote to in London?—I do not think I am at liberty to say. The letters were addressed to me privately.

2248. May I ask this—were they persons doing what I may call a West End trade?—No; an all-ends trade, I should think—all round London.

2249. Were they doing an East End trade, would you say?—I believe so, but I could not be certain.

2250. Do you think it is possible that an absolute restriction on the use of boric preservatives might tend to drive the trade of milk supply into the hands of comparatively few, but large corporations?—The information I got was from a very large firm.

2251. Supposing that we were to insist upon the absolute prohibition of boric preservatives, do you not think the small vendors in the East End, we will say, would be seriously affected?—To a certain extent they would be, because if I was to tell any milk seller that he had no business to sell milk after he had kept it, say, 24 hours or 30 hours, and then he said, "What am I to do with the remainder," and I said, "Boil it or sterilise it," why the small milk sellers would not be able to do that; of course they would not have the appliances. So it would to some extent affect them.

2252. They could not carry on their trade at a profit?—No; I quite see what you mean.

2253. The effect of that would be to drive the trade into the hands of a monopoly, or rather to make it a monopoly one?—To some extent it would.

2254. (*Chairman.*) Or to drive it into the hands of co-operative associations?—Yes.

2255. (*Professor Thorpe.*) Anyhow it would tend to restrict the vending of milk in comparatively few hands instead of making it absolutely free, as it is?—Yes.

2256. You think that might follow?—Yes.

2257. (*Dr. Bulstrode.*) Do you know anything as to the conditions of supply of milk in Belgium?—No, I could not enter into any particulars as to that, but I have read a good deal about it.

2258. If milk can be supplied to towns like Brussels, say, and Antwerp, without the use of preservatives, do you see any reason why that should not be so in Cardiff?—Not at all.

Dr. H. Handford.

23 Nov. 1899.

Dr. HENRY HANDFORD, called; and Examined.

2259. (*Chairman.*) You are Doctor of Medicine of Edinburgh, a Fellow of the Royal College of Physicians of London, and Diplomat in Public Health of Cambridge?—Yes, I am.

2260. You have been one of the honorary physicians to the General Hospital of Nottingham since 1885, I believe?—Yes.

2261. And you are in practice as a consulting physician?—Yes.

2262. You are also Medical Officer of Health for the Notts County Council, I think?—Yes.

2263. Has your attention been directed to the use of boracic acid as a preservative in food?—Yes.

2264. Could you give the Committee the result of your observations?—I should say that I have been familiar with the external use of boracic acid for a long time. I was inclined to look upon it as a harmless drug, at any rate compared with other antiseptics, but of late years my attention has been more closely directed to the effects of its internal use. I have used it on many occasions as an internal remedy for bladder diseases, but have found that in a large number of cases the use of the remedy has to be suspended on account of the irritating effect it produces upon the stomach and the loss of appetite that results.

2265. Would it produce that effect upon a healthy subject?—I have not given it experimentally, and all cases have been patients, but many of them have been healthy except in one or more local particulars. I believe it would produce the same effect in a certain proportion of cases in healthy individuals.

2266. What was the daily dose from which afterwards you observed the symptoms?—Ten grains three times a day. The result of my observation is that people vary very much in their susceptibility to the influence of it. Some persons can take that dose, that is, 30 grains a day for days or weeks with apparent impunity; others get pain and discomfort within a few days. In some cases the beneficial effect of boracic acid on the disease in question is so great that notwithstanding the unpleasant effects produced on the stomach and the intestine the patient will recur to the use of it time after time, so that practically an experiment is made. The unpleasant effects subside quickly when the boracic acid is omitted and return constantly when its use is resumed.

2267. Have you observed its effects upon children?—Yes. My attention was drawn to the effect of it in children in November of last year. We have a medical children's ward in the General Hospital, and at that time there was a good deal of diarrhœa in that ward. My attention was more especially drawn to one child, seven months old; it appeared to have nothing wrong except diarrhœa, for which I could not in any way account. From the symptoms I suspected the milk, and so I had the milk analysed, with the result that the Nottingham City Analyst certified that there were 28·96 grains of boric acid per gallon in the milk then being used. A copy of that certificate made by the clerk to the hospital I have sent in. (*See App. No.* 15.) As a result of finding boric acid in the milk the matter was referred by the House Committee to the Medical Committee, consisting of the seven members of the honorary staff. I may say they were all quite unanimous in disapproving of the use of boric acid in milk, and formulated a set of regulations for adoption by the House Committee for the prevention of such occurrence for the future. Those regulations have been adopted with one small exception, which refers to tuberculin, and the milk is now obtained by public contract. (*See App. No.* 15.) Those conditions are advertised in the newspapers, and the milk is obtained by contract without any difficulty, and without any addition to the ordinary prices on those terms. The milk is now analysed monthly.

2268. Do you know how much milk was being taken by that child daily?—It would take about two pints.

2269. Therefore it would be taking about seven grains?—I have not calculated it, but I presume it would be so.

2270. Taking it that the child was consuming seven grains a day, would that be a large dose for an infant?—I think it would be a very large dose; an infant at that age should take about a fifteenth of the dose that an adult requires. A dose for an adult is generally 10 or 15 grains.

2271. (*Professor Thorpe.*) Did you change the diet of the child?—We obtained milk free from boric acid.

2272. What was the effect?—The child got well rather slowly, but got perfectly well. Of course, I do not want to found too much upon one case, except that that drew my attention to examining the milk.

2273. (*Chairman.*) Would you expect that the consumption by a child of seven grains of boracic acid daily could be continued without perceptible effect?—I do not believe so. I feel very strongly that seven grains a day for a child of seven months must within a very short time produce prejudicial effects.

2274. Sterilisation, or boiling, of the milk would not effect a chemical preservative like borax, I presume?—No, except in this way. I believe the boric acid is not infrequently added as a powder, and then it is somewhat slowly dissolved; if the milk is boiled or sterilised that ensures the bringing of the boric acid into solution, and, in the same way, it would make the effect more certain, because if it is not boiled it would be unequally distributed, and you might get a large dose or a small dose when it is dusted as a powder into the milk.

2275. Would you approve of milk with a preservative added being sold under a notification by label?—I think milk is a very unsuitable article to distribute in that way, because the label cannot be attached to the milk, it can only be attached to a vessel. Therefore, it would be very difficult to be quite sure that the milk in question had reference to any label on the outside; it might be an old label. Again, it seems to me impracticable to have two kinds of milk in the house, one for the children and one for grown-up people, and to keep them separate.

2276. Would you regard the sale of preservative free milk as a question of administration and cleanliness?—I believe so. I believe if the dairies and cowsheds legislation were carried out with reasonable thoroughness that a great deal of the use of preservatives might be rendered quite unnecessary. There is a great deal of want of cleanliness in the distribution of milk at the present time.

2277. Do you think that the attention of the medical profession generally has been drawn to the effect of preservatives?—I think to a very slight extent only. So far as I know the use of preservatives has increased enormously in the last few years. Ten or fifteen years ago the subject received no attention at the medical schools, and I find that a very small number of medical men in practice know anything about the subject; it is confined chiefly to medical officers of health at present.

2278. Have you given any attention to other forms of food besides dairy produce?—Not very much; but I should like to say in addition that boric acid seems to be used very largely for preserving cream. It seems to me that that is quite as important as milk, because cream is used a good deal now in somewhat large quantities as a substitute for cod liver oil for invalids. Also there is an increasing number of infants brought up by hand at the present day—a proportion that is increasing year by year. For them cow's milk is used diluted, but in the process of dilution it becomes too weak in fat; and, therefore, cream is a valuable addition to the food of infants under seven months. If that cream contained boric acid I think it would be very prejudicial to infant life. Boric acid evidently allows milk to remain in a state apparently fit for consumption for a long time, and enables stale milk to be sold as fresh, which on many grounds seems to me undesirable. Also in its use both for milk and for articles like fish, it after a time rather disguises decomposition than prevents it. I have been asked to see samples of fish which had been preserved with boric acid. They were comparatively free from smell, but were evidently in an advanced state of decomposition, and in my opinion most dangerous as food. Because the smell was checked, to the unsuspecting the danger would be masked.

2279. Have you any knowledge how the boracic acid is added to the cream?—No, I have not.

2280. If it were added in the form of a powder it would be rather difficult to mix thoroughly, would it not?—Yes. I have heard from friends that not infrequently the particles of the powdered boric acid are visible in the cream, but I do not know that of my own knowledge. Then in regard to fresh meat, instead of using flour or some harmless dusting powder which used to be employed, boric acid is not uncommonly dusted on the ends of the bone and on the outside of so-called fresh meat, and prejudicial effects are known to have followed the use of that.

2281. Then in the daily diet of an ordinary healthy individual there are a variety of substances in which he may consume boracic acid?—That I only know from general knowledge and from conversations with the Medical Officer of Health for the City of Nottingham, so I cannot give that first hand. I have no doubt in my own mind that it is quite correct that it is found that a large proportion of ham and bacon, and a large proportion of sausages and eggs are preserved in it.

2282. Would you consider it a source of risk?—I think the important point is that small quantities in such a large variety of articles may result in a person unsuspectingly taking a large quantity in the total of the day's food. Although the quantity is small in each individual article, he may have it in half the articles he consumes in the day.

2283. (*Dr. Bulstrode.*) Could you tell the Committee anything as to the external use of boracic acid; you say you have had a large experience with regard to that?—It is used as a lotion, and it is used in the form of boric lint as a surgical dressing. I have never seen any prejudicial effect myself, but I have heard of ill-effects from the absorption of the boric acid in washing out a cavity, such as an empyema. I have not experienced that myself.

2284. Have you ever heard of any bad effects of washing the stomach with a boracic acid solution?—No, I have not heard of it.

2285. You state in your synopsis that the treatment of adults for cystitis by boracic acid would frequently produce certain symptoms of gastric disturbance; could you more particularly define "frequently" there?—I could not say in what proportion of the cases, but I take it some persons are much more susceptible than others, and in the susceptible persons it occurs constantly.

2286. Would you say that the term "idiosyncrasy" would apply to the reaction of certain persons towards it?—I think one might, but I do not look upon those persons as a very small minority. "Idiosyncrasy" is often applied to a very small minority as being rather the exception to the rule; I do not think it is such a small minority as that.

2287. Do you think that in the usual acceptance of the term "idiosyncrasy" does not cover the case?—No, I do not think it does. It is—by guessing, I should say—20, or 30, or 40 per cent.

2288. Now with regard to diarrhœa, have you any other ground than that one case, of which you have given us the details, for supposing that the administration of boracic acid is bad for infantile diarrhœa?—Not of my own knowledge; I have read of diarrhœa being produced by boric acid, but I have no other cases in my own knowledge.

2289. You have, I take it, as a physician, prescribed boracic acid to a very large extent?—To a moderately large extent, yes; it is not used a great deal.

2290. Would you tell the Committee what morbid conditions, in your opinion, are contra-indications for the administration of boracic acid?—That is rather a difficult question to answer. Of course, I should only give it for certain morbid conditions, and in those the benefit—for instance, say, in a case of cystitis—would be greater than any prejudicial effect it could have in a week. I have been accustomed myself to advise a patient to take it for a week, and then omit it for a week, and then take it for a week again.

2291. Owing to what?—Owing to the discomfort it produces. Patients come at the end of a week and say they have lost their appetite, and feel altogether out of sorts, and sometimes they complain of pains in the stomach. They say the medicine does not suit them, and they cannot go on with it—giving rather indifinite and general complaints. That is so frequent, and it occurs in the same patient so frequently, that I cannot have any doubt of the relation of cause and effect.

2292. Would you prescribe boracic acid in the case of nephritis?—No; I should not expect any benefit to nephritis from it.

2293. Would you expect any harm from it?—I have read that it does produce harm. I should not think of giving it for nephritis. I have read that nephritis may be produced by boric acid, but I have no personal knowledge of it.

Dr. H. Handford.

23 Nov. 1899.

2294. Do you ever hear of the action of borax upon the uterus?—Yes.

2295. Do you think that the reputed action is a fact or not?—I could not say; I have no knowledge of that. I have given borax for epilepsy in large doses. There again the appetite failed.

2296. You say you do not think the use of preservatives is recognised by medical men as a whole?—I do not like to say anything against my own profession.

2297. It is not much appreciated, say?—No; I do not think it comes much under the notice of doctors in ordinary practice.

2298. Would you bring that forward as a reason why the results of these things are not more generally known?—Yes, that is my reason in quoting it.

2299. That the bad result is not looked for?—That those dyspeptic symptoms are not traced to their proper cause, and that the real cause is often quite unsuspected.

2300. Have you had any experience with regard to preservatives other than preservatives of boracic acid or borax?—Very little.

2301. Not with regard to formalin?—Not as a preservative; but I have used formalin.

2302. You say in your synopsis: "As regards the quantity of boric acid consumed in food, I may point out that an adult fever patient taking five pints of milk in 24 hours to which boric acid in the proportion of 1 in 2,000 has been added would consume 21·875 grains of boric acid." Would you consider that a reason for regulating the amount of boric acid in milk?—I should strongly object to fever patients having any boric acid at all.

2303. Then that would answer a question I put to you before—the presence of fever would be a contrary indication for the exhibition of boric acid?—I should rather put it that everything is a contra-indication unless some beneficial action is expected to result. I am opposed to giving any drugs for dietetic purposes without they are given directly for the alleviation of some suffering or disease.

2304. Your opinion is that in the event of a preservative being put in a common article of diet, such as milk, the fact should be stated?—I think it would be better to have it stated than to have it unknown, but I am against the use of preservatives in milk in any case, because of the difficulty of keeping separate milk with preservatives, and milk without preservatives. I quote the fever cases because an ordinary adult in good health might drink a pint or half a pint of milk a day and the amount of boric acid in that would be quite trivial, whereas a fever patient will consume five pints or more, which would contain 20 to 40 grains or more. A patient with typhoid fever may be for days and often for weeks, almost at the point of death, and I should strongly object to giving him an irritating drug to the extent of 20 or 40 grains a day which would have no beneficial effect at all, and which might have some prejudicial effect.

2305. Do you think in the case of a drug it is important that a medical man attending a patient should know whether or not his patient is already taking more than the Pharmacopœial dose?—I think he ought to know whether his patient is taking any at all.

2306. With regard to the use of preservatives in milk, that raises a very serious question, especially to the poor; do you think the sale of a partially decomposed milk in the summer months is more likely to produce harmful results than the sale of milk to which a limited amount of boracic acid has been added?—That is rather a comprehensive question. If the milk has simply undergone a moderate amount of lactic fermentation I do not think it would do any harm, because it is the custom in many parts of Germany to always drink milk sour rather than sweet, and that is done with impunity. If the decomposition is of the nature of putrid decomposition, or from some other cause, then it will probably be more prejudicial; but I think the consumer would be protected from that by the objectionable taste and smell of the milk—he would not buy putrid milk.

2307. Do you think the addition of preservatives would tend to veil that at all in milk, speaking of milk alone?—I think it would to some extent; it would check it to a certain extent, and for a limited time.

2308. Do you think the consumer might get a dose both

Dr. H. Handford.

23 Nov. 1899.

of boracic acid and possibly of ptomaines?—Yes, I think he might.

2309. Do you think they would act as correctives one to another?—I have no experience of that, but I have no reason to think so.

2310. After you have had these symptoms of gastric disturbance, skin eruptions, and so forth, have you pushed the administration of boracic acid to see whether those symptoms have diminished or whether they have increased?—No, I have not felt justified in doing so. May I say that my object in quoting the difficulty in the case of the poor is that large consumers can always protect themselves by contract, but the poor have to take what they can get. I consume a large quantity of milk in my household, but I can go to a milk seller and get a written guarantee to supply me with so much a day at a certain price, guaranteeing that it shall be free from any preservative; while a poor person who takes half a pint or a pint a day cannot do that—he must take whatever he can get.

2311. (*Dr. Tunnicliffe.*) You said you did not attach very much importance to the one case of diarrhœa which came under your individual notice?—Yes.

2312. You have a very strong suspicion that boracic acid had to do with it?—That is my opinion, but I do not wish to bring forward that one case as a crucial one.

2313. (*Chairman.*) At the same time that one case had as a result the prohibition of the use of preservatives in the hospital milk from that date?—Certainly.

2314. You said there was a good deal of diarrhœa in the children's ward at the time of the observing of your case?—Yes.

2315. Did the absence of boracic acid in milk have a good effect upon the other cases of diarrhœa at the time?—Unfortunately in our hospital the patients belonging to the different physicians are mixed up in the same ward, and almost all the other cases in that ward at that time happened not to be under my own care, and I did not follow the other cases. We stopped the boric acid as soon as we found it out, and I did not anticipate bringing the matter forward on scientific grounds.

2316. With regard to the two kinds of decomposition in milk of which you spoke—namely, the lactic acid decomposition and the possible formation of ptomaines in milk—may I ask if you have had any experience of ptomaine poisoning from milk?—No, I have not.

2317. I am asking quite innocently—Do you know anything about it to enable you to give us information generally, either first or second-hand?—I do not know of any cases of ptomaine poisoning from milk; from meat cases have occurred not infrequently in Nottinghamshire.

2318. Supposing milk were to contain substances such as those ptomaines I have mentioned, and of which you are speaking, do you think that the presence of boracic acid in the milk would help to neutralise their effect?—I do not think so at all.

2319. (*Professor Thorpe.*) I gather that you are strongly of opinion that the use of boric preservatives in milk should not be sanctioned?—Yes, I am.

2320. Do you think that if it were sanctioned medical men would restrict the use of milk to invalids?—I think the medical men would be rather frightened at recommending patients to take a large quantity of milk unless they had some certain knowledge that it did not contain boric acid, just as they are somewhat frightened now at recommending milk without some guarantee agains tubercle. They can get that, to some extent, by boiling, but they have no means of neutralising any possible harmful effects of preservatives.

2321. And that restricted use of milk would be mischievous, would you say?—I think that would be mischievous all round, because in my opinion the country is capable of consuming nearly twice the quantity of milk that is at present used with benefit to the health of the people.

2322. What would you advise in the way of remedial measures against the possibility of unsound milk being distributed?—Greater cleanliness and cold storage.

2323. Do you think that a more rigorous enforcement of the Dairies, Cowsheds, and Milkshops Orders by the County Councils would have a beneficial effect?—I think it would result in the milk being very much cleaner.

2324. You think there is considerable room for improvement in the application of these Orders?—I know there is. In many places they are not carried out at all, and no attempt is made to carry them out.

NINTH DAY.

Friday, 24th November, 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. ALFRED HILL, M.D., called; and Examined.

Dr. A. Hill.

24 Nov. 1899.

2325. (*Chairman.*) You are Medical Officer of Health of the City of Birmingham, are you not?—Yes.

2326. And you appear also on behalf of the Incorporated Society of Medical Officers of Health?—That is so. I am also public analyst for the City of Birmingham.

2327. Are you prepared to give us some of the results of your inquiry into the presence of preservatives in food?—Yes, from the point of view of a public analyst and of a medical officer of health.

2328. Has the Corporation of Birmingham taken any general action to prevent the use of preservatives?—No.

2329. Or to regulate their use?—Not at all; only there have been prosecutions in cases of gross adulteration.

2330. What kinds of food have you submitted to analysis?—Principally the staple articles of ordinary diet, such as bread, milk, butter, cheese, pepper, mustard, coffee, flour, oatmeal, and all common articles of food, besides certain drugs.

2331. And also fresh meat?—Meat in various forms, not pressed beef, but sausages, polonies—perhaps you might call the preserved beef I examined as pressed beef and things of that kind—charcuterie, such as the things that are bought in an ordinary pork shop principally; also fish I have examined.

2332. Perhaps first you might give us the result of your examination of milk?—Yes. In the three and a half years ending September this year I examined 1,537 samples of milk for preservatives; of these 1,537 samples 135, or 9 per cent., contained either boric acid or formic aldehyde.

2333. Did you make a quantitative analysis with the view to find the proportion of the preservative?—Yes, in the case of boric acid, but not very much for the purpose of distinguishing the amount of formalin present, because it is a very difficult matter, and so it is only roughly comparative. I have made some investigations into formic aldehyde also; I find that it runs from about 1 part to 5 parts in 100,000, often I believe about 2 parts in 100,000—very small quantities, of course, by comparison.

2334. What have you found in regard to boric acid?—

Dr. A. Hill.

24 Nov. 1899.

That I have found varying, speaking from memory, from 5 grains to 126 grains in the gallon. In 1896 the proportion of the milk containing it was 8·3 per cent. The quantities, to be more exact, were that about half of the samples contained boric acid not exceeding 0·03 per cent. which reckons out at 21 grains per gallon; in one of the remaining quarters of these articles the quantities varied from 0·03 per cent. to 0·06 per cent., which calculates out to from 21 to 42 grains per gallon; while the fourth portion of these samples contained quantities up to 0·18 per cent., which is equal to 126 grains per gallon.

2335. Have you formed any opinion as to the reason for the great variation in quantity?—I do not think that the people who put it in know anything about it. I think they are very ignorant and they add indefinite quantities, and sometimes they add them in solution, and sometimes they add them in powder. I have some reason to suspect that where I found very large quantities the preservative had been put in as a powder, and had not been equally distributed, perhaps not equally dissolved in the milk. But the quantity varies immensely. Of course it might vary too from this circumstance: that a dairyman might mix a milk containing boric acid with another milk which did not contain it, and he might mix them in very varying proportions; so that the boric acid present in some cases would amount almost to a vanishing quantity.

2336. Do you know whether it is generally applied by the producer or by the distributor?—Principally by the wholesale purveyor.

2337. By the farmer?—Yes; I do not think the retail seller does it, or, if he does, it is very seldom. It is either the farmer or the middleman who buys it from the farmer and distributes it to the small retail sellers who does it.

2338. Do you think there is any chance of a double dose being given sometimes?—Yes, I know it is done sometimes—and perhaps even three times. The farmer may do it, the purveyor may do it, and the retailer may do it. This perhaps accounts in some cases for the high quantity found.

2339. That points to this, does it not, that whatever may be the physiological action of the drug, it is a drug which requires regulation?—Yes, it is a drug, and one which produces marked constitutional effects, sometimes of a very severe character and sometimes fatal. Where boric acid has been used for injecting into natural cavities like that of the pleura in surgical operations, or to wash out large abscesses, and for the injection of large quantities into the bladder, it has been known to produce death. I might also state that Dr. Annett, of Liverpool, has recently published some investigations of his on young animals—kittens—in which he found that as soon as he began to administer this drug in pure milk in the proportion in which it is used by the ordinary consumer that the kitten, instead of growing and getting heavier every week, got lighter and lighter as a rule every week, and in about five weeks died, so that there can be no question about the physiological effect of the drug.

2340. Has the use of these preservatives become more general, do you think?—It has, more particularly in milk with regard to formic aldehyde; the boric acid is going out of fashion somewhat, as more of it is required than of formic aldehyde, which is on the contrary increasing—that being a more potent agent.

2341. Have there been no prosecutions in your district on account of the presence of these preservatives?—Yes, on account of the presence of the preservative boracic acid there have been a good many. We have prosecuted, and successfully prosecuted, in almost every instance. I have a note before me to the effect that 2 per cent. of the samples obtained directly from the farmer contained preservatives.

2342. Would you regard the use of a potent agent like formaldehyde in the hands of an uninstructed farmer as attended with risk to the consumer?—Certainly. It would be more dangerous I think, and in any case it is objectionable and injurious whoever puts it in, because it is well known that it hardens albuminous matters and makes them very much more difficult of digestion. It was adopted for some time in the fish trade, but it was found to make the fish so hard as to render it quite unsuitable, and the practice has been dropped. Again, I may state that in microscopic work and in putting up animal preparations formic aldehyde is used for the purpose of hardening and preserving these tissues.

2343. Do you find the presence of these preservatives more frequent at one season than at another?—Yes, that is so; they are more common in summer than in winter.

2344. We now pass to butter and margarine: I understand you have submitted a large number of samples to analysis?—Yes. I have examined 871 samples in the last three and a half years; of those 871 samples 243 or 28 per cent. contained boric acid. From October to March 31 per cent. of the butter samples contained it, and from April to September 23 per cent.

2345. You were saying that it was more common in summer than in winter?—Yes.

2346. According to the figures you have read it is the other way?—Yes, it appears so. I was thinking of milk. That is very unaccountable.

2347. It corresponds with some evidence we have received from some other quarters?—I was speaking, I suppose, upon assumption at the moment. You are quite right.

2348. It would probably be accounted for by the larger output of fresh butter in the summer?—Yes, I think that is the explanation; then people are using English farmers' butter, which does not contain it.

2349. In margarine was it frequent?—In margarine it was much more frequent than in butter. Of 120 samples of margarine, including fat-adulterated butters, which are called margarine, though they do not consist essentially of animal fat other than the fat from butter, 101 samples, or 84 per cent. contained boric acid.

2350. Were the remaining 16 per cent. clear of all preservatives?—Yes; there was no boric acid or formic aldehyde. They do not put formic aldehyde into butter; I have never found it.

2351. Have you never found benzoic acid or salicylic acid?—No, not in butter. With regard to the quantity of boric acid present, I have lumped together the samples of margarine and butter, because the samples of margarine sold as margarine, and bought as margarine, were so few that it was hardly worth while separating them. Margarine is generally sold in place of butter as a deception.

2352. The next class with which you deal are meat foods, I think?—Yes. Of the thirty-three samples of meat foods that I examined twenty-one, or 64 per cent. of bacon, ham, sausage, and similar foods contained boracic acid in quantities varying from 0·15 to 0·65 per cent.; in other words, from 10 to 45 grains per lb.

2353. Did you find that higher quantity in ham and bacon—I presume you are talking of ham and bacon?—Ham, bacon, sausages, polonies, pork pies, and other kinds of food sold in a pork-butcher's shop.

2354. We are anxious to have information as to the presence of boracic acid in ham and bacon, but it is not quite clear how it gets there?—I think it is generally laid on, or rubbed on to the surface, but I do not profess to know much about it. I have seen it on the outside, and I know that it exists in larger quantity on the exterior than in the interior parts of the ham.

2355. Were these samples taken from ham and bacon that had been washed, and that were offered for sale?—They were taken from the shop. The inspectors bought perhaps a lb. of each, and submitted them to me. I know nothing more about them than that. We did not wash them; we took them just as they came from the retail shop.

2356. We are informed that the practice of the retail trade is to wash the meat directly it arrives?—Possibly, but I could not speak to that, because, of course, they would dry the outside of the meat again before selling it.

2357. Was the boracic acid present in the fat and muscle?—It pervaded the whole ham more or less, but it was more abundant on the external portion. In the chopped meats, sausages, veal and ham, polonies, and such things as those, it appeared to be equally distributed throughout, mixed up with the material before the meat was stuffed into the skins.

2358. Was it in a higher proportion, then, in those meats?—I do not think I have that point noted here; I do not think the quantity varied very materially.

2359. I suppose in the case of cured meat offered for sale the boracic acid would be visible in the form of powder on the exterior?—It might, or it might not.

2360. Your inspectors did not inform you about that?—No. You see if they saw it they would not be able to distinguish it from common salt. If he saw powder on the outside of the ham an inspector would not know whether it was common salt or boracic acid.

Dr. A. Hill.

24 Nov. 1899.

2361. Unless he tasted it?—Not unless he tasted it, and probably he would not do that.

2362. Then have you anything to tell us upon miscellaneous articles of foods?—Yes; twenty of the sixty samples, or 33 per cent., of cream, jam, vinegar, etc., contained boric or salicylic acid.

2363. That is rather a miscellaneous group?—Yes, it is.

2364. Take cream first?—The number of samples examined of thick cream was five, of which four contained boric acid, one containing salicylic acid as well; of clotted cream the three samples examined contained boric acid; of skimmed milk eleven samples were examined, and one contained boric acid; of malt vinegar twelve samples were examined, and one contained boric acid; of jam six samples were examined, of which five contained salicylic acid; of sherry twelve samples were examined, and one contained salicylic acid—no doubt the object of that was to preserve the wine, because it was so deficient in the alcohol that it was not strong enough perhaps to keep without a preservative. Then, of ipecacuanha wine—a drug—eleven samples were examined, and five had been preserved with salicylic acid. The total samples examined were sixty, of which nine contained boric acid and twelve contained salicylic acid.

2365. Now, in the case of ipecacuanha wine, a drug, would a retail dealer be justified in supplying as pure ipecacuanha a solution of another drug?—No, certainly not.

2366. Were any steps taken in those cases to prosecute?—I do not think we have had a prosecution in Birmingham, but I assisted the analyst of Wolverhampton in a prosecution in a similar case, and a verdict was obtained against the druggist. It is a very serious offence indeed. It is a more serious offence, perhaps, in regard to drugs than in regard to foods.

2367. Have you any record of the proportion in which salicylic acid was put in?—I have not. A sample of thick cream, and a sample of clotted cream, contained of boric acid 0·6 and 0·35 per cent. respectively, equal to 42 and 24 grains per pound. The separated milk and the malt vinegar contained 0·04 and 0·02 per cent., equal to 28 and 14 grains per gallon respectively—about the same proportion as you commonly find in milk and butter those are. In ten of the eleven prosecutions instituted for samples of milk or butter preserved with boric acid fines were inflicted. I think you asked me that question a short time ago. The other case was dismissed, as the vendor proved a warranty.

2368. Were not proceedings taken against the wholesale dealer?—No; that is a very difficult thing to do.

2369. (*Professor Thorpe.*) Were those samples taken from the city of Birmingham?—Yes.

2370. None from the outlying townships?—No; they were taken entirely from the district under my jurisdiction. I am analyst for the city of Birmingham alone.

2371. That is to say you are superintending from the point of view of a public analyst, the food of how many people?—More than half-a-million—about 530,000, I should think.

2372. Have you had occasion to notice, or has it been by any medical practitioner brought to your notice in Birmingham, that inconvenience has resulted from taking food containing those preservatives?—Yes, on many occasions.

2373. Would you kindly give us some information about that?—Dr. Vachell, from Glamorganshire, who came to Birmingham as a witness in a case, and who is Medical Officer of Health in Glamorganshire, and surgeon to a hospital, said that in administering boric acid in bladder complaints he frequently found he had to desist from its use for a time on account of the constitutional and local disturbance which the remedy occasioned, such as an eruption on the skin, stomach and intestinal troubles, and sometimes depression of the heart, and fainting. Another medical man in Birmingham gave me information of the same kind from his own experience. That is the experience of physiological investigators; they find those symptoms, and even some worse—they find sometimes that there is effusion of blood round the kidneys with very serious consequences.

2374. Would an outbreak or the undue prevalence of infantile diarrhœa, for example, come under your notice in Birmingham?—Yes, of course, it does, very much so. I have frequently thought that probably the presence of boric acid in milk might aggravate an epidemic. We suffer a good deal from diarrhœa in Birmingham—more than most large towns.

2375. Have any steps actually been taken to connect possibly the presence of boric acid in milk with the prevalence of diarrhœa in children?—No, it has not been followed out with that view. As analyst, you see, I only take the samples that are submitted to me and certify to the chemical results.

2376. I thought perhaps you might have attacked this problem from the point of view of medical officer of health?—No. It is a very obscure one, I am afraid, and very difficult. The poor people who suffer very much from diarrhœa take their milk in very small quantities, and from very promiscuous sources, and therefore I am afraid an investigation would be a very difficult thing.

2377. Would such people be more liable than, say, the wealthier part of the community to get milk with boracic acid in it?—They are more predisposed to diarrhœa by a number of circumstances—by their bad feeding, and their bad clothing, and the dirty conditions in which they live, the want of air, and the want of light; the health tone is lower, and they would suffer more than a person of robust constitution.

2378. Would they be liable, I asked, to get milk containing boracic acid more than the wealthier part of the community?—Yes, certainly.

2379. Why?—Retail dealers in the town sell milk containing boric acid; in fact, I think we get more boric acid in retail milk than we do when it comes from the farmer. It is put in either by the middleman or by the retailer—I do not know which.

2380. The wealthier part of the community would get retail milk too?—Yes, but they get it from a better purveyor probably, who is a man of higher respectability: but even they have milk, with boracic acid in it. I had a sample of milk sent me the other day from Edgbaston—our West End—and I found it was very highly charged with boric acid—and it was a good quality of milk, too—it was splendid milk.

2381. Have you found that more than one preservative is met with in articles of food?—Yes, I have found two; frequently I have found boric acid and formic aldehyde in the same article.

2382. In milk, for example?—Yes.

2383. I gather that you are of opinion that the use of formic aldehyde is on the increase in Birmingham?—Yes, I think that boric acid is giving way to formic aldehyde.

2384. In Birmingham?—Yes; our numbers of formic aldehyde are increasing.

2385. Now, on the whole during the three and a half years what has been the relative proportion of foods containing preservatives which you have found in the aggregate?—Of 2,621 samples the number containing preservatives is 520, making a proportion for all kinds of articles mentioned by me of 20 per cent. The list includes butter, margarine, meat foods, and miscellaneous articles, and 20 per cent. is the total amount. For milk it is 9 per cent., for butter 28 per cent., for margarine 84 per cent., for meat foods 64 per cent., for miscellaneous articles 33 per cent., making altogether an average of 20 per cent., as I have said, or one-fifth.

2386. Is there any special objection to the use of formic aldehyde as against boric acid; which of the two preservatives is the more innocuous?—I do not think I am in a position to say positively what I think on that subject. I have performed no comparative experiments. Formic aldehyde is the stronger of the two, but then it is used in a smaller quantity.

2387. Have you had any examples brought to your notice in which injury has resulted from the use of formic aldehyde?—Not to me in my capacity either as Medical Officer of Health or as Public Analyst.

2388. Now, in the case of margarine, why should such a relatively high proportion contain antiseptics?—That is a question which I have put to myself, and to which I have not been able to find a satisfactory answer. I should have thought from its nature it would have been less prone to decomposition than butter fat, and that an antiseptic would have been less necessary in the case of margarine, but, as a fact, it is more common a good deal. I cannot explain why; it certainly would not be so disposed to turn rancid as butter fat.

2389. Could you give the Committee the information upon which your statement of the relative frequency of the prevalence of boric acid in milk has been obtained; you say that it is more frequent in the summer than in the winter?—Just looking down my own records of my own analyses; they are my own numbers from my own analyses——

2390. I ask the point rather particularly because we have had evidence before us to show that it is more frequent in winter than in summer in the case of milk?—So I have said.

2391. You have said, I think, the opposite?—I made a mistake, but I have not got it so in my notes.

2392. Pardon me, it was in butter that you made the slip; in the case of milk you say that it is more frequent in summer than in winter?—Yes, which is what I should expect. That made me make the mistake about the butter, I have no doubt.

2393. But I say we have had some evidence before us that it is more frequent in winter than in summer?—The custom may vary, of course, in different localities—I am speaking of my own locality.

2394. Would you think that the relative abundance of the milk might have anything to do with the presence or the absence of the boric acid?—I do not think there is more milk produced at any time than is consumed.

2395. Of course in winter milk is scarcer than it would be in summer?—Yes, possibly.

2396. And it might be necessary for a purveyor of milk to hold on say to the last quantity of it for the sake of his customers, inasmuch as he has no doubt to keep up a definite amount of supply?—That might very possibly be an explanation.

2397. It has been your experience, I believe, that samples of milk containing preservatives are more frequently adulterated with water or skimmed milk than samples free from preservatives?—Yes, that is so.

2398. The water is possibly there from the fact that the boric preservative has been previously dissolved in the water?—I think that the water is too much for that. I think there is adulteration by water as well as the addition of a solution of the boric acid—I should say so.

2399. What do you think that fact indicates, namely, that in a watered sample of milk there should be boric acid apart from the fact that a solution of boric acid might have been added?—I am sure I do not know, except it would be a lower class of tradesman who had to deal with the article; that might possibly influence it.

2400. You think there is no more necessity to add it to a watered milk than to any other milk?—I do not see why it should be; I do not think it would be more prone to decomposition.

2401. In the case of the circumstance that the skimmed milk when found is associated with boric acid, that would mean, I presume, that old milk had been mixed with comparatively fresh milk?—The skimmed milk?

2402. You say that some of the samples of milk contained skimmed milk or were mixed with skimmed milk?—Yes.

2403. I asked you whether the presence of boric acid there would mean that fresh milk had been mixed with comparatively old milk preserved by boric acid?—I really could not say. Of course, it is possible, but I have no means of knowing the circumstances under which these things are handled at all.

2404. Do you think that is probable?—Yes, it seems so. Of course, the older the milk the more likely it is to contain a preservative. It would not be days old if it did not contain a preservative; at any rate, it would not be more than forty-eight hours old. If you want to keep milk for four, or five, or six days, then naturally it must contain a preservative, and in an increasing proportion.

2405. What I want to ask of you is whether you think that the legalised use of boric acid in milk would render more easy this fraud of the admixture of skimmed milk, and presumably, therefore, old milk with fresh milk?—It would not prevent the detection of the absence of the fat.

2406. No; but my question was, would it facilitate the fraud; would it allow the fraud to be more frequent?—I think it would. The longer you keep the milk in the hands of the tradesman the more likely it is to be treated with a preservative.

2407. And if so treated it might be mixed with fresh milk?—Yes.

2408. And vended as fresh milk?—Certainly; and I have no doubt it is.

Dr. A. Hill,
24 Nov. 1899.

2409. And when it might be in a state of incipient change and decomposition?—That is so. I not infrequently find samples of milk containing boric acid and also lactic acid, so that the boric acid does not preserve the milk, and there are two acids to contend with instead of one.

2410. Turning to the meat foods, you have found that the amount of boric acid present ranges from 10 to 45 grains per lb. in the twenty-one samples in which boracic acid was found?—Yes.

2411. Can you tell us in which particular articles the maximum quantities were found?—No, I have not a note of that. I think they run pretty equally, and think the figures I have given you for them generally will be proved to be about correct.

2412. Do you think there would be as much as 45 grains per lb. in a bacon or a ham?—I am not prepared to say without the figures before me.

2413. I think it would be convenient if you who have had so large an experience could send us these quantitative determinations?—The quantity in ham I think you said?

2414. My particular point was this: we want to get some information as to the actual amounts which are present in ham or in bacon, because there seems to be a considerable discrepancy of statement?—I will send those. (*See App. No.* 13.)

2415. (*Dr. Tunnicliffe.*) Have you had under your own individual notice any case of boracic acid poisoning due to the presence of boracic acid in food of any kind?—No, I have not.

2416. Is the same true of formic aldehyde and salicylic acid?—Yes. It is out of my way altogether. I do not practise, and therefore these cases do not come to me in that form.

2417. Not in your capacity as Medical Officer of Health, I take it you mean?—No.

2418. You have expressed rather strong views on the subject of formic aldehyde as being poisonous?—Yes, I have.

2419. Therefore I would ask you directly if you think that one part or two parts of formic aldehyde in a hundred thousand parts of milk would be injurious?—Not poisonous, but more or less injurious, from the fact that it would harden the albuminous or nitrogenous constituents of food, and it would also have an inhibitive effect no doubt upon the process of digestion.

2420. Are you prepared to give the Committee any facts to support that thesis?—No, I am not.

2421. With regard to the opinion you have expressed upon the injurious action of boracic acid, is it a fact that it was mostly derived from instances in which boracic acid had been used to wash out the cavities of wounds?—Yes, and in the medical treatment of cases.

2422. Also in the medical treatment of living cases?—Yes.

2423. But not in association with the food stuffs?—No.

2024. With regard to the action that you took against the chemist who used salicylic acid in *vinum ipecac.*, *vinum ipecac.* is in the Pharmacopœia?—Yes.

2425. And in the directions for *vinum ipecac.* in the Pharmacopœia nothing is mentioned of salicylic acid?—Nothing except sherry wine and ipecacuanha root.

2426. Would the same objection apply to the sale of a drug or medicinal agent which is not in the Pharmacopœia, and, hence, concerning which he is under no obligation with regard to the actual preparation?—The same physiological objection to it, do you mean?

2427. I mean the same legal objection?—What is the question exactly? Will you ask it again, if you please?

2428. In the case of a drug in the British Pharmacopœia definite directions are given to the chemist for the purpose of preparing it?—Certainly.

2429. If he does not comply with those regulations, I take it that you can proceed against him as a druggist?—The Pharmaceutical Society can. I do not suppose I have the power to do it.

2430. (*Professor Thorpe.*) Pardon me, why not—it is not of the "nature, substance, and quality" demanded?—No, it is not.

2431. Cannot you bring an action under that section of the Act?—Yes, but unless you can prove it to be injurious you never get a conviction. If you bring an action

Dr. A. Hill, 24 Nov. 1899.

against a tradesman under that section to which you refer, as not being of the nature, quality, or substance of the article demanded, they run away from that 6th section at once up to the 3rd section, and ask about its injuriousness to health, under which no prosecution has taken place, the prosecution having been taken under the 6th section dealing with the points you have just mentioned. Then the analyst is not a medical man, and he is instantly required to prove that its addition is injurious; he is not competent to prove it; he is in no way competent; he is not even a medical man. Then somebody on the other side for the defence comes forward and gives strong evidence that these things are not injurious, and the case is always dismissed. That is our great difficulty.

2432. You are speaking, of course, generally?—Yes.

2433. Now, here is a specific case of the presence of a drug in another medicament?—Yes.

2434. And a drug which is known to have a certain potency?—Yes.

2435. Surely you have power to act there?—I should think we have the power, but we have not done so in such cases that I am aware of. We have the power, no doubt.

2436. (*Dr. Tunnicliffe.*) You state that in your experience you have regarded formic aldehyde as a far more potent agent in the preserving of milk than any other agent that you have had experience of?—Yes. I judge from the fact that a very much smaller amount of formic aldehyde is sufficient to effect its purpose.

2437. I was not speaking of any deduction on my part; I was speaking of what you had actually experienced?—I have not experienced any ill effects from either.

2438. I did not say ill-effects; you did not quite grasp what I said. I will put it in another way. In those milks and butters which have contained a preservative, and yet have been rancid, has the preservative been less frequently formic aldehyde and most frequently boracic acid?—In butter?

2439. Well, milk and butter, taking them together from this point of view?—The most frequent cases of milk have contained formic aldehyde, but with regard to the butter we never find formic aldehyde in butter, but only boric acid.

2440. The most numerous cases in which there have been both decomposition and a preservative—that was the point that I asked especially?—Boric acid.

2441. Does your own experience lead you to the view that formic aldehyde is far more efficacious as a preservative than boric acid?—Yes, I believe so.

2442. This is a matter of fact, not of opinion, is it not?—Yes, it is. That is a matter of experience in the laboratory.

2443. But you do not attach any absolute importance to what you yourself have said with regard to the poisonous nature of the formic aldehyde?—No, it would be simply founded upon my general information. I do not claim absolute importance for it at all; I have made no experiments. There are others you can call who are much more competent to give an opinion upon that point than I am.

2444. (*Dr. Bulstrode.*) Have you any experience of outbreaks of diarrhœa amongst children of which you have not been able to detect a cause?—The causes are so very numerous; I think several causes can always be found for diarrhœa.

2445. The possible cause I mean?—If you mean have I been able to connect it with the preservatives in food, I may say I am not in a position to do that.

2446. Have you ever investigated an outbreak with the knowledge in your mind that the milk might possibly contain much more than the pharmacopœial dose of boracic acid?—No, I cannot say I have.

2447. Do you think it is possible that if medical men knew the extent to which apparently boracic acid is used, we might possibly account for outbreaks which at present we have not been able to account for?—Yes, it is possible, but I have not investigated any outbreaks with that particular object.

2448. I think you have studied the question of autumnal diarrhœa?—Yes.

2449. Did you ever consider the question as to whether possibly the maintenance of infantile autumnal diarrhœa might be kept up by the relatively modern practice of adding preservatives to milk?—I have had my suspicions that it does aggravate the thing, but I have had no positive proof of it. Certain towns suffer much more from diarrhœa than others.

2450. In any given town where preservatives were added as in Birmingham, who would be more likely to get the boracised milk or the formaldehysed milk, the upper classes or the lower classes?—I should say the lower classes.

2451. Amongst what class is infantile diarrhœa most prevalent?—The lower—the lowest. The lower you go down the scale the more diarrhœa.

2452. You have pointed out to the Committee that New York State has a law which regards any and every addition to milk, whether a preservative or not, in any quantity, as an offence?—Yes.

2453. In any quantity?—Yes, in any quantity. There was a gentleman from New York State at the Conference at Southampton a few months ago. I made that statement there in some remarks I made, and he corroborated me from his own experience. Nothing is allowed to be added to the milk in any quantity whatever, whether a preservative or not.

2454. Do you know that the use of preservatives in milk is prohibited in Belgium, in several cantons of Switzerland, and in Austro-Hungary?—Yes, so I hear.

2455. If the people of, say, Vienna—I cannot speak as to Geneva, as I do not quite know as to the practice there—and the people of Switzerland and of Brussels and of Antwerp are able to get on without preserved milk, do you see any reason why the people of Birmingham cannot do the same?—Certainly, I think they can do the same; I do not think the preservatives are necessary.

2456. Now I have looked at this table of yours with reference to the amounts of preservative, of boric acid, which you have found in articles of food in Birmingham; I think I have taken perhaps a rather extreme view, but I have calculated out roughly that suppose I visited Birmingham for a day and had such things as I am accustomed to want; if I were unfortunate in hitting upon the samples which you have done, containing most of this boracic acid, or nearly the most—I have not taken the extreme cases—I might take nearly 50 grains of boracic acid during the day——?—Which is more than a full dose of the drug in cases of actual illness, taken under medical supervision.

2457. The ordinary dose in the British Pharmacopœia is 5 to 15 grains, and the maximum dose is 45 grains according to the British Pharmacopœia; I might take that full maximum dose——?—And something more.

2458. And then I might have something wrong with me which indicated the administration of boracic acid. I might go to a physician in Birmingham, and he might give me another dose of 45 grains?—He might possibly.

2459. It is quite possible?—Yes, it is quite possible.

2460. Do you think that this indiscriminate treatment of food materials with what is alleged to be a drug may handicap the medical profession in the treatment of their patients?—Certainly, and unquestionably it does.

2461. As regards milk in Birmingham I think you said that only 9 per cent. contained either boric acid or formalin?—That is so.

2462. In other words, of all the milk of which you took samples——?—That were submitted to me by the purchaser——

2463. Only 9 per cent. contained preservatives?—Yes, that is so.

2464. This question, you will probably agree, is a relative one. I mean, if you found all the samples submitted to you contained preservatives, you would probably conclude that there was a great commercial necessity for preservatives?—Certainly.

2465. But, finding, as you do, 9 per cent. only containing preservatives, you would be inclined, I take it, to infer that it was not a very serious financial matter with the trade?—No, and that it was not necessary.

2466. You would go further, and say it was not necessary to use preservatives?—If 91 per cent. of the samples of milk can be distributed perfectly fresh without preservatives, it seems to me a proof that preservatives are unnecessary provided the milk is carefully handled, and is kept clean and kept in a proper place, and kept cool.

2467. Do you know anything with regard to the bacteriology of milk?—No.

2468. Do you think that the popular estimation of the badness of milk by the presence of lactic acid is a safe criterion as to the changes that have taken place?—Not at all. There are incipient changes which I believe would disorder the stomach and bowels, which are not perceptible to taste or smell.

2469. Do you think it possible that in spite of the production of lactic acid being inhibited, in other words, of the bacteria producing lactic changes being killed or inhibited, that there might be other bacteria more resistant which were producing changes which might produce far worse results than lactic acid in the human economy?—I could not say, I am sure.

2470. Do you think it is possible?—I do not see the necessity myself for employing the preservatives.

2471. You say in your synopsis that you have "frequently examined samples of milk which were sour on receipt, though containing boric acid or formic aldehyde"; of course, if they were sour they would be undrinkable, and in that sense the public would not be prejudiced in any way, would they?—I do not say how sour; the public will drink milk that is slightly sour; of course they would not take it if it were very sour.

2472. In reference to the question of finding more boracic acid in butter in winter than in summer, could you give us any idea as to how Birmingham is supplied with butter at one and another time of the year?—No doubt in the summer it is more largely supplied by the local farmers in the neighbourhood—by the English farmers, at all events.

2473. And in the winter?—In the winter it would come from Kiel, Denmark, France, and Holland.

2474. Does that afford an explanation to you?—I think so.

2475. We have had it in evidence that during the winter months there is an effort made to get the grass-fed butter?—Yes.

2476. And that therefore in winter it comes in from Australia, and that the Australian butter is preserved with preservatives?—That is not my experience; my experience is that Australian butter contains no preservative.

2477. Could you give the Committee the extent of your experience in reference to Australian butter containing no preservative?—It is simply this, that samples which I have been informed are Australian butter have been destitute of preservatives.

2478. It is all preserved in cold?—It comes over preserved by cold; enormous quantities of it come over to this country preserved by cold.

2479. (*Chairman.*) I will take you as shortly as possible through the next branch of your evidence, namely, the presence of colouring matters in food?—I have not very much to say about that, I am afraid.

2480. You have devoted some analyses to that, have you not?—Yes, I have given a little attention to it. Certain samples have come to me coloured.

2481. Have you examined any preserved vegetables for colouring matter?—Very few. Most of those I have examined have been free from colouring.

2482. Most of the preserved vegetables?—Yes, such as peas, beans, gherkins, and anything of that kind.

2483. Were they off colour at all?—Those that did not contain copper were not so green, of course, as those that did. I do not think that the question of health should be sacrificed to the question of colour.

2484. I agree with you?—In piccalillies and other pickles the vegetables are not green, they are generally of a yellow colour, and people do not object to them, and I do not know why they should insist upon gherkins and French beans being so very green. If they do, I think a green should be found of a non-poisonous character; I presume chemists would be able to furnish some harmless green. Of course, the general green colouring material is sulphate of copper, which is decidedly an injurious substance.

2485. Are there any other food products which you have examined for colouring matters?—Milk is sometimes coloured with a yellow material, which sometimes seems to be of an aniline character; but, of course, the quantity of solid colouring matter present in milk is excessively minute, and it is very difficult to make out its nature. Sometimes I believe annatto is used, and possibly turmeric. In confectionery years back I found chromate of lead used to give a yellow colour, but I have never found that in recent years; the practice seems to have died out. "Demerara sugar" I frequently find coloured. It is not Demerara sugar, but it is so-called Demerara sugar. I believe it consists of beet sugar coloured yellowish or brownish by an aniline dye, but the quantity is exceedingly minute.

Dr. A. Hill.

24 Nov. 1899.

2486. That would be a fraudulent addition to the sugar, would it not?—Yes.

2487. Have any proceedings been taken?—Yes, in the case of Demerara sugar, but not in the case of the other things; in fact, we get no confectionery now treated with poisonous colours; all the colours are innocent vegetable colours, and so they are in milk, I believe. The other day we had the case of a man who was selling milk from a cart in the street, and the inspector asked him what was in a second can. He made some objection to the inspector finding out, but the inspector looked into the can, and found it contained water coloured a pale yellow. That was added to the milk, no doubt, from door to door. The bulk of the milk in the churn was genuine, but there was this can of yellow water in the cart, and I have no doubt he added this from time to time, the object being probably to hide the blueness of the milk caused by the abstraction of the cream.

2488. Did that take place in Birmingham?—Yes, quite recently.

2489. Were any proceedings taken?—No, we could not proceed.

2490. Why not?—I did not see that we could. In the first place I could not make out the nature of the dye; and then we had no proof that he had put it into the milk—you see, it was in a separate can in the cart. I do not see how we could have proceeded. He had a perfect right to carry coloured water in his cart if he liked, if he did no harm with it. Of course we suspect that he intended to employ it in colouring the milk and in diluting it too.

2491. Do you know whether that purveyor is still carrying a can of yellow water?—No; I do not know that we have followed him up. I think I shall suggest that we do.

2492. (*Dr. Bulstrode.*) You have put it in evidence that bad results accrue from sulphate of copper, and I think you said that many prosecutions have taken place; may I ask you whether the prosecutions were successful on the basis of injury to health through the use of these colouring matters?—I have not said that we had prosecutions under that head.

2493. In your synopsis you say: "Twenty years ago I found that a number of samples of confectionery were coloured with such injurious substances as chromate of lead, but the resulting fines soon stopped their use. Copper compounds are still used to colour peas and a number of prosecutions have taken place in various parts of the country"; you could not give particulars of those cases?—No; I have had no prosecutions myself for coloured peas.

2494. Have you formed any idea as to what is the best manner to deal with colouring matters, which may possibly be injurious to health?—Of dealing with them by law, do you mean?

2495. By law?—I have had no cases, so I have no experience in the matter.

2496. Do you know that in certain countries, such as Belgium and France, they schedule certain colouring matters which contain certain specified metals, and prohibit their use?—Yes.

2497. Do you think there is a necessity for such a scheme in the United Kingdom?—I think it is desirable to protect the public from having such drugs administered to them against their will, or against their knowledge.

2498. Do you think some such scheme as is adopted in other countries might meet the case?—I think it ought to be adopted here.

2499. (*Professor Thorpe.*) I should like to ask you whether you have come deliberately to the conclusion that the use of preservatives ought to be prevented by law?—That is the conclusion I have come to.

2500. You would see no difficulty in the supply of a food—for example, milk—to a large city like Birmingham by obviating the use of preservatives?—I see no difficulty. I think the application of cold is perfectly easy. Fishmongers have their ice wells at the backs of their premises, where they keep their fish for a considerable time. We have cold stores in Birmingham for the preservation of meat and other articles of food; and there is no difficulty at all in the preservation by cold in the same way of milk and other perishable articles; in fact, I am sure that cold is more effective as a preservative than any

Dr. A. Hill.

24 Nov. 1899.

mineral or drug, and it does not alter the nature of the article in any way. It does not take anything from it, and it adds nothing to it.

2501. Is it not a fact that many articles of food which have been preserved by cold, on leaving the cold store very rapidly deteriorate?—I do not know; I have no experience of it. I have eaten meat from cold stores frequently, and I have never perceived that condition of things. I do not see why it should be so.

2502. (*Chairman.*) Do you think that articles supplied to the public under the title of "fresh"—"fresh milk," for instance—are sold with an implied guarantee of date, or is the word "fresh" merely a trade expression?—I think it means milk recently taken from the cow; I think that is the idea conveyed by "fresh milk."

2503. That is the impression upon the public, and not an unnatural one?—No doubt about it—it does not mean material that has been kept; it means milk fresh from the cow.

2504. Therefore that milk should not contain any preservative?—No.

2505. Unless its presence is notified to the public?—It should be declared certainly—not only its presence, but its quantity too.

2506. I understand that you would not be satisfied by a mere notification, but you prefer its prohibition?—Its prohibition I should prefer, certainly, very much—more particularly as I consider it unnecessary.

2507. (*Professor Thorpe.*) What would you understand by "fresh butter"—is it something in contradistinction to salted butter?—Yes, that is the distinction; it is butter that does not contain sufficient salt to preserve it for a long time.

2508. Would a butter, say, six months old, coming from New Zealand, and kept from "going off," as it is called, by the use of boric acid, be "fresh butter"?—I should call it "fresh butter."

2509. You would call that "fresh butter"?—Yes, because it is in the condition in which it was when first made. It has not changed; it has been preserved in its pristine condition by the cold. If it has undergone any change whatever in chemical composition, or if it is heavily salted, I should say then it is not fresh butter, but salt butter in the latter case.

2510. The term "fresh butter," of course, dates from a time when only salt was used as a preservative?—That is so.

2511. Is it not a carrying over of a term in another sense?—Perhaps it is. There is a great difference, may I remark, between salting articles to preserve them, and preserving them by these chemical substances which we have been talking about. It is proved that these substances inhibit the digestive processes, while salt does not. If the digestion of a substance without salt is looked upon as 100, then the same food eaten with an ordinary amount of salt would be 99, so there is only a loss of one per cent. of digestive power; whereas, with all these other things, there is a very considerable amount of reduction of the digestive power.

2512. I should like to ask you from your experience of the working of the Food and Drugs Act whether you think it would be possible to obtain a conviction against a man selling butter—so-called fresh butter—some six or eight months old, which has only been kept in a reasonably good condition by the aid of boracic acid?—The conviction would be on the ground that it was adulterated or that it contained a preservative which was injurious to health. It would not be a question of calling it by any particular name, I think; the prosecution would be on the fact of there being a preservative there.

2513. Do you think that the consumer would not be prejudiced if he asked for "fresh butter" by getting something which was not really fresh butter in the common acceptation of the term?—I think he might, because I do not know that the preservative would be sufficient to preserve. As I say, we find foods containing preservatives which have not been preserved in their fresh state, but have begun to decompose. That is the case with milk very commonly.

2514. I am not thinking of any decomposition being there. I am only thinking of a man going into a shop and asking for fresh butter, understanding by that really freshly-made butter; for that, I suppose, is what he does mean when he asks for it?—As long as it is really fresh; that is to say, has undergone no changes, I consider he is not prejudiced.

2515. (*Dr. Bulstrode.*) You stated, I think, just now with regard to the preservatives, the use of which we have been discussing, such as boracic acid and formaldehyde, that they were prejudicial to the digestive processes?—Yes.

2516. Could you refer the Committee to your authority for that statement?—There are many authorities. There is Förster and Schlenker in Germany; there is Chittenden in America; there is Rideal in London; and Annett of Liverpool; and a great number of other names I could give you.

2517. Do they all agree that the use of these preservatives retards the digestive processes?—In some dose or other.

2518. In doses of varying amounts they may act differently on the digestive processes?—Yes. Chittenden holds that a moderate quantity is not injurious, but he shows that a large quantity is injurious. It is impossible to say that a dose that would not injure one man would not injure another. There are idiosyncrasies, as you are aware, and therefore it would not be safe to give the drug promiscuously, and to have that drug administered by people who know nothing about its effects, and do not know anything about doses or anything of the subject. I think it is most dangerous.

2519. (*Dr. Tunnicliffe.*) I think you said in answer to a question from Dr. Bulstrode that formaldehyde and boracic acid in your opinion exerted, so to speak, a selective action——?—An inhibitive action.

2520. Excuse me a moment, a selective action upon different varieties of bacteria in milk or in butter, as the case may be?—No, I did not say that; I really do not know anything about it.

2521. You said that the rancidity of milk, the acidity of milk might be prevented, but other decomposition might go on, which was not apparent to taste or smell, the result of which might be injurious?—I was simply speaking of the extent of the decomposition then, I was not making the distinction that you seem to point out.

The shorthand writer read the following questions and answers:—"(Q.) Do you think it possible that in spite of the production of lactic acid being inhibited, in other words, of the bacteria producing lactic changes being killed or inhibited, that there might be other bacteria more resistant which were producing changes which might produce far worse results than lactic acid in the human economy?—(A.) I could not say I am sure. (Q.) Do you think it is possible?—(A.) I do not see the necessity myself for employing the preservatives."

(*Witness.*) I do not think the point you speak of is there.

(*Dr. Tunnicliffe.*) The point is there, but I did not gather your answer correctly.

(*Witness.*) May I be allowed before leaving to say that I represent the Society of Medical Officers of Health on this occasion. They wished me to be the representative of their views. May I read the resolution which they passed, upon which I may be supposed to act?

2522. (*Chairman.*) We shall be very glad indeed to hear it?—This is the Resolution:—"That the Society strongly disapproves of the practice of adding preservative chemicals to milk and other foods. That if preservative chemicals are added to any food a full disclosure as to their nature and amounts should be made to the purchaser."

Dr. J. S. Cameron.

Dr. James Spottiswoode Cameron, called; and Examined.

2523. (*Chairman.*) You are a member of the Royal College of Surgeons of England?—Yes.

2524. And you are Medical Officer of Health of Leeds?—Yes. I am also a Doctor of Medicine, a Bachelor of Science, and a Master in Surgery of the University of Edinburgh.

2525. You come before us as a practitioner as well?—Yes, to some extent. I am asked by the British Medical Association to give evidence on their behalf; and I may perhaps say that I have been President of the Yorkshire Branch of that Association, and also of the Yorkshire Branch of the Associated Society of Medical

Officers of Health. I have also held the Presidency of the Medical and Chirurgical Society of Leeds and the West Riding, and of the Huddersfield Medical Society; so that I have some little knowledge of the profession.

2526. Has your attention been directed to the subject of our inquiry, namely, the presence of colouring matters and preservatives in food?—Yes, a good deal in a general sort of way. Whilst I have been a Medical Officer of Health for ten years entirely, I was before that a Medical Officer of Health, and also in practice; so I have the practical side, as you remarked, as well as the Medical Officer's side.

2527. First, as to the Medical Officer's side; have you become aware of the frequency of these substances?—Yes, we have had, especially since attention has been directed to the subject, a great many cases where borax or boric acid has been added to milk and to other foods, but especially to milk and butter. Then for a long time back we have noticed that a large quantity of peas have been sold which have evidently been coloured by copper. Those, perhaps, are the cases that I have noticed mostly.

2528. Taking the milk supply first, can you give us the figures showing the proportion in which preservatives have been found?—I am afraid they would not go very far. I have a little table here that I have prepared, from which I may quote. Attention has been in Leeds especially directed to the subject lately. I find that in 1898 our analyst examined 200 ordinary samples of milk of which boric compounds were found in one, at least, he reported finding them in one; and three samples of condensed milk, of which he reported that in two boracic acid in some form was found. Then in the present year, previous to about the 18th September, 176 specimens of milk were sent to him, and he did not report borax or boracic acid in any of those; and five specimens of condensed milk were sent to him, and he did not report it in any of those. But since the 17th September 49 specimens of ordinary milk have been sent to him, and he has found boric compounds of some kind in 25 of them, that is 51 per cent. During the whole year fifteen other specimens, one pork and fourteen butters, were sent, and he found boric compounds in the only specimen of pork sent, and in four out of the fourteen butters. In regard to these thirty-three samples of milk and milk products, which I have mentioned in which borax or boracic acid was found —fourteen came from inside and nineteen from outside our own town, that is to say, in regard, for instance, chiefly to the milk—and it is chiefly in milk that it has occurred —the products were from farmers outside, and had been sent principally by rail into the town. Then, in addition to those, since the 17th September our inspector has taken sixteen samples, in what I call an unofficial manner, that is, without saying that they were for analysis, and dividing them each into three parts. In four of those sixteen boric compounds were found.

2529. Can you tell us the proportions in which they were found?—In no case, I think, was there more than 20 grains to the gallon of milk, that is, 20 parts in 70,000.

2530. Five grains in a quart?—Yes. The analyses were not made quantitatively, but I had some conversation with the analyst on the subject, and he found that he could tell approximately quantitatively what the amount was by the method he adopted.

2531. Do you know if boric compounds such as glacialine and others are in domestic use at all?—I do not think they are to any very large extent. I have heard very little of it. At the same time they are on the market. Glacialine is sold in small boxes at 6d., and it is sold quite freely over the counter in the shops. Boric acid is also sold quite freely; of course it is sold for surgical purposes, and also distinctly for the purpose of preserving milk. I got the inspector to send a milk dealer only yesterday, he got sixpennyworth of boric acid without any difficulty; he said it was for use in preserving milk. As to the domestic use I cannot say very much about it; I think it is probable that they are used occasionally, but I do not think they are used very much.

2532. In your opinion is the public aware generally of the use of these preservatives?—I do not think so at all.

2533. And also in your opinion do you think the public runs any risk from their prevalence?—Decidedly. I think that the boric compounds are compounds which, like all substances having a preservative effect, that is to say, staying to some extent the decomposition of protoplasm, interfere naturally with the digestive processes. Then in regard to copper in peas, I think there is no doubt that copper in large doses is a poison, and in small doses I cannot regard it as without effect—even in comparatively small doses, if taken frequently. I think that if a person is in a delicate state of health—a person, say, with kidneys that are to some extent diseased—there would be a danger of increasing the mischief by the addition frequently of even small doses of a substance like copper.

Dr. J. S. Cameron.

24 Nov. 1899.

2534. Have you made any experiments or observations yourself on the action of boric acid upon the human subject?—No, I have not, except, of course, that I have frequently given it when I was in practice as a mouth application to babies for thrush. I have not made any experiments to ascertain how far it is poisonous.

2535. I suppose there is a limit, is there not, to the quantity which an infant may take with impunity?—I should think the limit would be a very small quantity, and one would, of course, want to know that the infant was not already taking it. If one were giving borax to an infant for special purposes one would like to know that it had not been already dosed with it to a large extent in its food. I think this is one of the great dangers in a substance like that being added without any statement that a drug is actually there. It might be the very drug that the medical man might want to use. He might be unknowingly giving a very much larger quantity than he intended to do.

2536. Supposing an infant were to drink a quart of milk containing 20 grains to the gallon, he would be getting a full dose, would he not?—Yes, he would be getting a full dose.

2537. (*Professor Thorpe.*) You have mentioned more particularly glacialine; is that the only article of that character that you know of sold in Leeds?—No; there is boric acid.

2538. But you know of no other trade articles containing borax?—No, I do not know of any at present.

2539. Is infantile diarrhœa very prevalent in Leeds?—It is very prevalent, and I am sorry to say it is not so much less prevalent as I should like to see it. I find that during the first three years that I have figures for in Leeds, our death rate from diarrhœa was 0·98 per thousand—not infantile diarrhœa alone, but all diarrhœa, although that is principally infantile. Those figures cover from 1890 to 1892. From 1893 to 1895 it rose to 1·21 per thousand; and in the last three years of 1896, 1897, and 1898 it was 1·17 per thousand. Looking at that from a Medical Officer of Health's point of view, knowing that we have been sending out hand-bills to all parts of the town where diarrhœa is prevalent, pointing out that milk ought to be boiled, and knowing also that we have been taking special precautions in the way of scavenging, it is very difficult to get rid of the suspicion that there is some factor which keeps up the amount of infantile diarrhœa, notwithstanding what we are doing to prevent it. We are taking much better means to prevent it than we were, say, nine years ago, and yet it is not less than it was. Of course, one must remember that a great deal depends upon the weather. If we have one or two years with very hot and dry summers, that would alter our statistics for those two or three years; so that one cannot say that that is the only point. At the same time, it is one of those suspicions one cannot quite shake off. One feels that there may be some other factor, and I confess I have felt for a year or two back that possibly articles like boric acid put into the milk may have something to do with it.

2540. You have a children's hospital in Leeds, have you not?—We have a hospital called the Women's and Children's Hospital.

2541. Where there are a considerable number of young children?—I cannot tell you the exact number; I do not think it is a very large number.

2542. Is it a maternity hospital?—No, it is a hospital standing, as it were, by itself; but it has not a very large number, I cannot tell you the exact number, of beds. There are children taken into the infirmary as well. It is not, for instance, like the Great Ormonde Street Children's Hospital, entirely for children. They take in diseases of women—gynæcological cases.

2543. Are any precautions taken with respect to the milk supply of those places?—I do not know. As to our own fever hospital, we have a very stringent clause in regard to the purity of the milk, and we have very frequent analyses made of the milk. We have a large number of children, of course, in the fever hospital.

2544. Would any cases of boracic acid in the milk there be reported?—We get all our milk from one man, and analyse it. If there is boracic acid in that milk we should refuse to continue it. I do not think boracic acid is

Dr. J. S. Cameron.

24 Nov. 1899.

especially mentioned in the contract, although the quantity of the ingredients is; but an analysis is frequently made, and it has not been reported as having boracic acid to my knowledge.

2545. Are you able to tell us anything respecting the specific action of salicylic acid?—Yes; I think so. It is, of course, used in medicine very much for diseases like rheumatism, and it has a very powerful action on the liver. It is a frightful depressent, and is used largely in the form of salicylate of soda, which is an alkaline form. In frequent large doses it brings down the tension of the pulse, and it reduces a person to an exceedingly weak state. I have seen sometimes small doses of salicylic acid cause poisonous symptoms; but I think in those cases the acid was impure, containing probably carbolic acid. Of course, large doses will cause sickness readily.

2546. Have you any opinion to offer as to the use of salicylic acid as a preservative—whether it should be allowed or forbidden?—I think it should be entirely forbidden.

2547. Even if declared?—Yes, even if declared.

2548. You have given some attention, I believe, to the question of copper in peas?—Yes.

2549. I believe you have made some experiments as to the conditions under which it may be dissolved out from the peas?—Yes. Some few years ago, when Dr. Maclean Wilson (who is now with the West Riding Rivers Board) was working with me, I asked him to carry out a series of experiments, which he did. I suggested the experiments, and supervised them step by step. This is what we did: Professor Fraser, of Edinburgh, had stated in evidence that the copper in peas was in an insoluble condition, and I thought I should like to see whether an artificially prepared digestive fluid would dissolve it. We first of all found that the tin containing the peas did contain copper, because we could get copper by throwing it down by galvanic action. Then we went on taking the dry peas and pounding them up, and adding a little hydrochloric acid to them, and dissolving them for a certain length of time, and then filtering. We got no copper through, showing apparently that the ordinary slight amount of hydrochloric acid which one might expect in the stomach did not dissolve any of the copper out of the peas. Then, to a small quantity of the peas we added a little hydrochloric acid, and a teaspoonful of Benger's liquor pepticus. Then we incubated that for, I think, twenty-four hours at body heat, or a little below it—98 degrees—and filtered the fluid through filtering paper. From that liquid which had been through the filtering paper we had no difficulty in separating copper by the galvanic current. Then we tried a similar experiment using an alkaline solution instead of an acid one. We used a little carbonate of soda, I think, and the liquor pancreaticus of the same maker—a Manchester firm. We got also copper in that. Then we took the residues of these two, mixed them together, and treated them again with liquor pepticus, and again we got a slight quantity, but a comparatively slight quantity of the copper. After we had done that we incinerated the remaining peas, and we could scarcely get a trace of copper at all. We had apparently dissolved out nearly the whole copper. First of all, the acid solution dissolved some, then the alkaline solution dissolved some, and then we got a further amount of copper when we mixed the two residues together; so we practically exhausted the copper from the peas by that process.

2550. What is your inference from your experiments?—My inference is that the digestive system of a man may also do the same thing that these liquids, which are prepared from the stomach and the pancreas of the pig, can do—that the same process practically goes on.

2551. Then may we take it that you are in conflict with Professor Fraser on that point?—Entirely. I should add that I have not seen any further statement of Professor Fraser's lately; his statement was made before these experiments were made, and I do not know whether he still adheres to it.

2552. Have you any theories as to the mode in which the copper is held by the peas?—No, not further than that it is in the form of an organic salt of copper. Of course, I have heard various names given to it. I should suppose that it is probably in intimate relation with the chlorophyll, but I do not speak as a chemist on that matter.

2553 Have you any other information to give us, generally speaking, as to what is known as to the action of copper?—Copper, of course, is a reputed poison, and I have never seen in practice any reason to suspect that it is not so. I am aware that Professor Lehmann, I think it is, of Wurtzburg, made experiments some years ago on his students, in which he gave them, I think, peas containing copper, and none of them died, and he did not find that there was anything very far wrong with them. But Professor Lehmann was not a medical man, and his experiments were made upon healthy individuals, and, after all, only over a comparatively short time—I mean that his results were immediate results, not remote results. What I fear in slow poisons like copper is that the result would remain long after the giving of the copper. I might perhaps be allowed to draw an analogy from the manner in which lead poisoning occurs. It is frequently said that if such a large quantity of peas containing copper is sold, medical men ought long ago to have pointed out cases of copper poisoning due to peas. I was in Huddersfield as Medical Officer at the time that it came to be known that lead was in our water supply. For several years after I knew myself that lead was in the water supply, while I was looking out carefully among my infirmary patients for traces of lead poisoning I found only a very small number, and I found that such cases were not reported in the statistics given me fortnight by fortnight from the Medical Officers of the various districts of the union, although meanwhile I came across a few in private practice. For several years they were comparatively few. Then when it became well known that lead was a possibility in the water supply it seemed as if medical men were much quicker to detect symptoms of lead poisoning; and one might almost say that when it was known that lead was largely in the water, that almost a new clinical history of lead poisoning had to be written. Instead of the classic lead poisoning of Tanquerel we had really to enlarge our descriptions, for we found lead poisoning took very much more numerous forms than had been suspected. I think in the case of copper if it were generally known who had used copper that in the course of 10 or 15 years there would be a large amount of information as to what amount of danger copper might do; but in the meantime a medical man on going to see a patient suffering, say, from an acute attack of kidney disease, has a suspicion that the man has been injured, perhaps years before, in regard to his kidneys, but he does not know anything about that man's diet during those years, and the man himself does not know whether he has been taking copper in his peas or not.

2554. Is copper a cumulative poison?—To some extent, yes.

2555. But not to the same extent as lead?—I do not think quite so, but I do not think we know quite sufficient to speak dogmatically upon that subject. It is found, I believe, also in the bile.

2556. Have you had any case of copper poisoning under your observation?—No. I remember one or two cases where I had brassfounders who were suffering from symptoms that I was at the time inclined to consider due to copper poisoning; but I am not quite sure on reconsidering whether the zinc may not have had something to do with the poisoning there. Although there is not very much evidence about the chronic poisoning there is plenty of evidence, of course, of acute cases.

2557. Speaking as a Medical Officer of Health, are you inclined to favour the legalised use of preservatives?—No. I should rather be inclined to put it in this way—that anything not a natural constituent of the food, or if a natural constituent of the food, anything which is put in in larger quantity than it would naturally appear—in excessive quantity—ought to be declared to the purchaser at the time of the purchase just as much as chicory should be declared when it is put into coffee. I should state that the colouring matters like copper and the compounds of boric and salicylic acids, I should of course bar altogether. In the case of compounds like formaldehyde, anything of that sort ought to be declared, I think, so that a man should know what he is taking, and should have a right to refuse to take it.

2558. Have you had any knowledge of the use of formaldehyde?—Not as a food preservative.

2559. (*Dr. Tunnicliffe.*) I should like to ask you if you have made any experiments for a shorter time than 24 hours in the digestion of the peas and copper—you said you incubated it 24 hours, I think?—I think it is very likely we did, but I do not remember at present. A man generally goes to the closet only once a day, and I think the probability is that if he took peas the peas would remain in his digestive canal for getting on for 24 hours; so it was an approximate imitation of the natural process. Of course in a laboratory experiment 24 hours is a convenient time to take, because you go to your laboratory about the same time again next day.

2560. The question is the time of digestion, not the time of remaining in the alimentary canal; that is the reason I ask the question?—The whole of the time it is in the alimentary canal, or nearly the whole of the time, it is subject to the different digestive processes—in the stomach to acid digestion, and in the intestines to alkaline digestion; and so for that purpose we tried two processes to see whether either and both would have some effect.

2561. Do you think that the active absorption of copper might go on under the influence of digestion in the large intestine, for instance?—Yes, in the large intestine I think it might to some slight extent be absorbed; but it would be principally in the small intestine that digestion would occur.

2562. Can you tell us the average time of food remaining in the stomach?—I do not remember what it is at present; I should say probably about two or three hours.

2563. May I ask you what you mean in your synopsis by "antiseptic ingredient limits protoplasmic action"?—There is a natural alteration of tissue which takes place—sometimes a destructive alteration—more frequently destructive than otherwise—and all the processes or changes are limited by the action of these antiseptics. Of course the most common result is the limiting of the fermentative processes. All fermentative processes more or less consist in breaking down higher forms into lower forms, reducing sugar, for instance, into carbonic acid and alcohol. Anything of an antiseptic nature would prevent that action probably partly by restraining the action of the bacteria or the enzymes that were present. Of course, the digestion in the alimentary canal is due to enzymes of various kinds which are interfered with to some extent by antiseptics.

2564. Do you think it necessarily follows that if a substance has an inhibitory action with regard to the life of a given bacillus it will have also an inhibitory action with regard to the life of any other bacillus or micro-organism?—I think the probability would be that it would have to some extent—not always to the same, but to some extent.

2565. It must be a matter of quantity, very likely?—I think there is a certain amount of selection, and that a thing which would destroy one bacillus would not destroy to the same extent another bacillus; but I think that anything of an antiseptic nature, such as boracic acid, would probably do more than merely destroy the bacillus—it would render the material, in which it is, less prone to break up easily.

2566. Anyhow, you admit that there would be a selective action with regard to antiseptics?—Yes, in regard to bacteria.

2567. With regard to the action of the acid upon the bacteria?—Yes, it would select to some extent the bacterium. It would act more powerfully upon certain bacteria than upon others. I think that is the way I should prefer to put it.

2568. Therefore, you would regard with some suspicion any *a priori* statement as to the necessarily poisonous effects of antiseptics quâ antiseptics—do you follow my question?—I do not quite see the "therefore."

2569. Would you think that because a substance acted like formic aldehyde in preventing the decomposition of milk it would, as such, necessarily be poisonous to man or to a higher animal, irrespective of quantity?—I think my position would be rather that a thing like formic aldehyde which would prevent the decomposition under bacterial action of certain organic substances would also retard the decomposition of the food into the peptones that we want to have for nutritive purposes.

2570. Would you say that without experimental data?—Yes. I should think that was a probability.

2571. (*Dr. Bulstrode.*) Do you know of any substance which has what you spoke of just now as a selective action upon bacteria. I mean not a relatively selective action; but an absolutely selective action, so that it would touch some bacteria, and would leave others absolutely alone?—No, I do not quite know that, but I think one might say, for instance, that carbolic acid would act less powerfully upon typhoid bacteria than it would upon ordinary putrefactive bacteria.

2572. In the same way that different degrees of heat will produce a certain effect on one bacterium, and another on another one?—Yes.

Dr. J. S. Cameron.

24 Nov. 1899.

2573. With regard to this very interesting question of infantile diarrhœa, and the possible connection between the preservatives and the maintenance, as I understand you, of diarrhœa in our large towns, your position would be, would it not, that possibly boric acid may be one factor in preventing the fall which we as sanitarians were led to hope might have taken place ere this?—That is exactly it. I merely throw it out as a thing that has struck me; but I cannot give you anything to prove it.

2574. Can you tell us when the diarrhœa is most prevalent?—In the autumn.

2575. Can you tell us when the preservatives are more likely to be used in milk?—Certainly at the same time—when the weather is hot.

2576. And what class would be most likely to get the preservatives, do you think?—The poorer class, because the milk is less carefully carried to them, and is apt to be kept longer on the way. They are apt to get it after the wealthier class have had their supply.

2577. Have you ever made any investigation in reference to this infantile diarrhœa or outbreaks of infantile diarrhœa, as to whether preservatives in milk have been an element of causation?—No, I have not any special observations with regard to that.

2578. But you would rather be inclined, as I gather, to put preservatives and the history of lead poisoning somewhat on the same level?—I think it was rather in regard to poisoning by copper that I was speaking of lead poisoning. I was drawing an analogy, and my special object in saying so much about that was rather to show that an important and egregious poison like lead might be overlooked for years, although it is present; but as soon as people knew it was present then medical men had an opportunity of judging what the effects were. I wished to argue on the same lines that if it was declared that copper existed in certain things in which, of course, we, as medical officers, know it does frequently exist, then the people who bought it would have a sort of mental note that they had taken copper at that time, and if their doctor asked questions about it they would be able to tell him so; but at present they know nothing about it.

2579. Do you think that the labelling of the fact that the milk contained, say, boric acid would meet the objection which I know you have towards it?—I should personally prefer to forbid it absolutely, I do not think it is at all necessary; it is quite possible to preserve milk without it.

2580. Would you prefer if it were labelled to have the amount stated as well?—That would be very difficult; I do not think a man could really tell the amount exactly.

2581. Do you think that unless the amount were put on it would protect the public and also afford the medical man assistance in the treatment of disease which he ought to have?—I am rather inclined to think the result would be that if a man put on a label saying: "This milk contains boric acid," the doctors would very soon say, "You must not drink that milk at all."

2582. You think that would be the effect of it?—Yes, I do not think people would buy milk with boric acid after a little while.

2583. What do you think the medical profession will do now, suppose as a result of this Committee nothing happens? Do you think it would modify the attitude of the medical profession towards the prescription of milk?—If this Committee reports that there is a great deal of boric acid put into milk, but it is not desirable to do anything; if this Committee also said that boric acid did no harm whatever—a position which I do not suppose the Committee would ever take—then probably a certain number of the medical profession would follow the suggestion that it was a harmless thing, and would not interfere. If, on the other hand, this Committee were to come to the conclusion that a large quantity of boric acid was put into milk, and that it was a dangerous thing, I think then that medical men generally would be inclined to inquire a little more about it, and would advise people to make inquiry whether boric acid was in their milk. But I do not think that that would apply immediately to the poorer class, who suffer most from diarrhœa; they do not consult a medical man until they are very ill indeed, and they are not acting generally speaking under the advice of a medical man.

2584. They might be suffering for some time from a condition which perhaps contra-indicated boracic acid, and yet be receiving large doses of it?—Yes.

2585. Have you ever been called to cases of diarrhœa in children which you thought might have been caused by

Dr. J. S. Cameron.

24 Nov. 1899.

boric acid?—It has never occurred to me. I have not been in practice during the last ten years, and it did not occur to me at any time when I was in practice that the diarrhœa was due to boric acid. Of course it is largely since that time that the use of boric acid has become so prevalent; I mean the use of it was not so great before.

2586. You have not been able to trace the behaviour of diarrhœa in Leeds side by side with the extended use of preservatives, have you?—Except so far as I have mentioned the figures already, namely, that during the first three years of the last nine, our death rate was lower; during the second period it was higher; and during the third period it was a little lower than during the second, but higher than during the first period. I can give you, of course, if you like, the exact data I have got; but I cannot give you the quantities of boracic acid. We have not heard very much of it until lately, we have not known much about it; but I have no doubt it has been there, and it has been certainly increasing. I may add that in the last two years—1897 and 1898—the death rate from diarrhœa has been 1·58 and 1·24. Those are with two exceptions the highest death rates we have had during nine years, and we have not had two consecutive years with quite such high death rates; fortunately, the year before brought down the average of the triennium.

2587. (*Chairman.*) Would you prohibit the use of colouring matters in food?—No, I think not; but I should certainly advise that they be declared. I think that whatever is put into a food which is not a natural constituent of the food ought to be declared.

2588. You are aware I suppose how prevalent colouring matter is in certain dairy products—cheese, for example?—Yes.

2589. I suppose in Huddersfield your people will not touch cheese unless it is highly coloured?—They eat Stilton cheese, which is not very highly coloured.

2590. Do the working classes there eat Stilton cheese?—I do not think they get the chance very much.

2591. Take those two bottles; one contains a coloured sample of lard, and the other a sample out of which the colour has flown; it is a fugitive colour—(*Handing two samples to the witness.*) Would you think it necessary to declare that a cheese coloured up to that standard, which is the usual standard, I think, should be declared as coloured?—I should not think it necessary in regard to cheese. I think the colouring matter of cheese is generally annatto; I am not quite sure, but I think it is.

2592. Would you approve of a classified schedule?—I should be inclined myself in regard to the colouring matter in milk sold as milk, to forbid it absolutely. I say the use of annatto, which is probably a perfectly harmless thing, is misleading; it is put into the milk deliberately to make the milk look richer than it is.

2593. The same may be said of the cheese, may it not?—Yes, it might be; but, of course, cheese has been so universally used coloured for such a very long period of time that people have got accustomed to it.

2594. (*Professor Thorpe.*) Would you prohibit any colouring matter in butter?—No, I should not care so much about it in butter.

2595. There is no suspicion there of altering the richness?—No; people know that butter is artificially coloured I think pretty well.

2596. (*Chairman.*) Might I ask if you would hesitate to eat preserved peas which you know to be coloured with copper?—Do you mean for a single occasion?

2597. Habitually?—I should not take them habitually certainly.

2598. You would not?—No, I would not have them in the house.

2599. And would you warn your patients against them?—I should warn my patients against them. I do not think that a single dose, if one may call it so, a tablespoonful, say, of peas containing half a grain of copper to a pound, would do a person any harm; not a single dose.

2600. If I understood your evidence rightly, you consider that the effect might be cumulative?—Yes, I think so.

Dr. J. D Mann.

Dr. JOHN DIXON MANN, called; and Examined.

2601. (*Chairman.*) You are a Doctor of Medicine of St. Andrews, a Fellow of the Royal College of Physicians of London, a Member of the Royal College of Surgeons of England, and a Licentiate of the Society of Apothecaries?—I am.

2602. Also a Professor of Forensic Medicine and Toxicology, Owens College, Manchester, and Examiner in Forensic Medicine in the London University, and the Victoria University, Manchester?—Yes, I am. I might also add, if you will allow me, that I am physician to a hospital, and that has a little bearing on what I shall have to say. I am physician to the Salford Royal Hospital, which may possibly give a little colour to my evidence from the clinical aspect.

2603. I think you are prepared to state to the Committee certain conclusions at which you have arrived as to the effect of the addition of certain substances to food?—Yes, I am.

2604. Will you proceed, if you please?—First of all, with regard to so-called preservatives generally, the ground on which I base objections to the use of such substances in food may be divided into four heads. (1) In the first place, some of these substances are in themselves undoubtedly injurious, intrinsically injurious, and (2) some are probably injurious under like conditions.

2605. You are talking now only of preservatives, I understand?—Yes, and (3) as to whether or not the preservative has such action on the food as to retard and in some degree even, possibly prevent, digestion of that food, at any rate to retard it. Then there is (4) a further ground of objection, a fourth ground, which is that these preservatives added in the proportion in which they are added, to foods to preserve them, do not absolutely sterilise the food. That is pretty well proved by the fact that if you add a certain quantity, say, about 30 or 33 grains of boric acid to the milk it will keep it sweet for a certain length of time, and only for a certain length of time, showing that its power of preservation is limited. I think I have grounds for believing that preservatives so added to milk in this way, boric acid particularly, may keep the milk sweet, so far as any ordinary appearance, or the evidence of the senses in the ordinary way goes, and yet may admit of certain changes in the milk which produce injurious products, due to the presence of micro-organisms. In the first place, with regard to milk, I believe that the addition of boric acid to milk is prejudicial to the nutrition of infants who obviously live for the most part on milk. Further, I believe, and without having direct proof, I have very strong grounds for believing, from observations among the out-patients at the hospital with which I am connected, which, I may say, is placed in a district abounding with poor people, that women feed their young children on milk to which these preservatives have been added, especially boric acid (by that I include borax, which, of course, is only a combination), and with very prejudicial results to the children, so far as their nutrition goes, and by causing diarrhœa, vomiting, and other similar troubles. On two occasions this last summer, before I knew anything at all about this inquiry before your Committee, women brought children to the hospital who were very much emaciated and suffering from constant diarrhœa which is usually attributed to changes in the milk produced by the summer heats. I obtained specimens of milk in both these cases, and took them to my laboratory, and I ascertained the presence of boric acid in both specimens.

2606. In what quantities?—I am not prepared to say; I merely ascertained its presence. The quantity of milk furnished to me was too small to permit of anything further; in fact, one of the women had brought the bottle which the child was sucking, and I emptied it on the spot into another bottle, and took it away; the other woman brought me a specimen; both specimens were too small to ascertain the amount. That is one ground on which I would object to the presence of boracic acid in milk. If I might state my opinion I would say that boric acid, in my opinion, ought not to be allowed to be added to milk at all, which forms the fundamental nourishment, in fact the entire nourishment during the early months of childhood; and although I cannot give you any direct proof—no demonstration, that is to say—of injury, I can give you the result of my experience and I say that it strongly points to the fact that injury to the health of young children is caused by the presence of boric acid in milk.

2607. Did you follow the history of these two children any further?—No, excepting that when I told the mothers to use for a time preserved milk, the women brought the children another time, and the diarrhœa had ceased. I cannot pretend to say anything further, because, as you probably know, out-patients at a hospital are not like private patients, and you cannot follow them up. They disappear, and the only conclusion you draw is that the child is better; it is quite true the child might be dead. I cannot say I followed them up, I have no means of doing so. I have seen myself several cases of boric poisoning not produced by food, but, in some instances—in two or three instances at any rate—by applications to the surface of boric ointment to wounds. Not very long ago I was called by one of my surgical colleagues in the hospital to see a case, to know what was the matter with a patient, and I saw at once that it was a case of boric poisoning. He had a purpuric rash on the body, and the patient was feeling depressed and losing appetite. I have also seen another case in a child that I remember, or two cases—also hospital cases—in which the child was very ill-nourished, and in a very feeble state of health. I accidentally learned in the one case, in the other case I inquired, having had the suggestion made that the mother was applying borax and honey to the child's mouth, and had been doing so for many weeks. This is a common remedy, and a very useful remedy for what is commonly called thrush; but the mother, in her anxiety to keep the child well as she thought, had gone on administering this stuff for a considerable period—many weeks; when it was stopped the child quickly recovered. I do not absolutely say that it was cause and effect, but my suspicions are strongly directed to that view. That is an instance, and perhaps the only one. There are very few instances where you can give anything like direct evidence of what you may call chronic boric poisoning—acute poisoning is not uncommon. It does not occur to me to say anything more about the borax just now. The same objections in a degree would apply to the use of formalin, because formalin hardens organic matter, and certainly retards if it does not altogether prevent digestion. Of course it is a question of degree. If present to a very large amount it would absolutely prevent digestion; but in the amount in which it is added as a preservative usually, as far as my knowledge goes, it would probably not absolutely prevent, but would retard the digestion of such foods. This is particularly the case with the pancreatic digestion. I made a few experiments myself, upon which I do not wish to lay any great stress, because they were done for my own satisfaction rather than for any special purpose; but I certainly could see very plainly a very small amount of retarded pancreatic digestion.

2608. As to the relative frequency of boracic acid and formaldehyde?—In milk, are you speaking of?

2609. Yes?—This is a little wide of my duties, but I should myself say that there is no doubt that boric acid is much more frequently used; I mean to say I am not a Medical Officer of Health, and it is not my business to analyse these things or to go into the statistics of them.

2610. No, but you have just mentioned an instance in which you did undertake an analysis, or direct an analysis?—That was in my own laboratory for private purposes—really just as a private investigation. I was going on to say with regard to the other substances, as an instance of the first mentioned kind, that is, of preservatives that are undoubtedly prejudicial in themselves, I would mention salicylic acid. Of that I can give personal experience, as it happens, and, with your permission, I will communicate it.

2611. Please do?—Last year, in the summer—not this present summer, but the summer before—at lunch at the club, I took to drinking cider, and I got an acquired taste for the cider, and continued taking it for many weeks. I began to feel a peculiar tendency to looseness in the bowels, not a diarrhœa, but a distinct looseness in the bowels. Furthermore, I felt never, as it were, thoroughly relieved after motions. This went on for a time, and I could not understand how it was. I thought it was accidental in the first place, but it kept going on week after week. I did not care to take any medicine, and I began to cast about what possibly could be the cause of it. I went over the things I had been in the habit of taking, and of the things I was taking at that time. I could not think of anything until it struck me about this cider. So I ceased taking the cider, and in two days I was all right. I got a bottle of the same sort from the steward of the club, took it to my laboratory, and found salicylic acid in it, and, needless to say, I have not taken cider since. It is very seldom that you can get anything like a satisfactory demonstration of the action of these things when they are taken in infinitesimal doses. Take a poison like lead—chronic lead poisoning nobody would dispute, of course—but I would willingly drink lead water, for a limited time, that would poison me eventually. Many of the experiments that have been made with food preservatives to prove their innocuousness are simply made for a limited time, and they are of no value whatever. There is not the least doubt that a small quantity of water that would eventually cause chronic lead poisoning, and bring on colic, paralysis, and all the other symptoms, might be taken for a limited time—I would drink it for a week in the ordinary way without any compunction and without any effect, supposing, of course, it was in an infinitisimal quantity, for I would not say I would take it in any strength.

2612. (*Dr. Bulstrode.*) I rather gather from you that your view is that the lactic acid taint in milk need not, or should not, be taken as an evidence of the degree of harmful changes which have taken place in the milk?—I would rather say there may be other changes taking place independently of that which may produce injurious substances.

2613. Would you say that it is possible, or could you give any evidence to show that the addition of boric acid might inhibit the lactic changes, while not inhibiting the vital manifestations of other micro-organisms?—I cannot give you any direct evidence. Again, I have made some rough experiments, but I do not want to lay much stress upon them, because I have not attempted to follow these things up. It is a very time-consuming matter. I went so far, for instance, as to take milk in the fresh state, and estimated the amount of micro-organisms in a drop, and then to the same milk added some boric acid, and kept it for some little time, at the end of which time—it would be something over 24 hours—the milk was apparently quite sweet, and I could not detect any difference in it, but there was a considerable multiplication of the micro-organisms.

2614. Do the bacteria producing lactic acid form spores, as far as you know?—That is out of my line; I cannot venture to give you an opinion on that point.

2615. With regard to your statements in reference to the harmful effect of preservatives, such as we have been discussing upon the digestive processes, are you familiar with the experiments of Chittenden, Rideal, and Foulerton?—Yes.

2616. Do you think they all point in the direction which you have been stating?—They mostly do.

2617. That is your reading of them, that they all point in that direction?—Yes. There are a number of other experiments which possibly you can get from foreign sources. I do not much care for experiments done for a special object, but there are a number that have been done abroad—in Germany and Switzerland—on the same subject, and they all point in the same direction with various degrees of force—that is to say, some draw more forcible conclusions than others, but mostly in the same direction, namely, that these preservatives do inhibit the action of enzymes.

2618. Perhaps you would mention three workers who you consider bear out that view most apart from Chittenden, and those whom we have already referred to?—Bliss and Novy, in the Journal of Experimental Medicine—that is an American journal.

2619. Date?—January, 1899. With regard to formaldehyde there is Zuntz, and there is another paper by Benedicenti in the "Achiv für Anatomie und Physiologie" (the "Physiologische Abtheilung") for 1897. Then another is Linossier in the "Bulletin de Therapeutique" for 1898; he gives an account of experiments with formaldehyde. He says that 2·5 per thousand arrests the action of the pancreatic ferment, and 0·6 per thousand has a very pronounced effect. A certain quantity of albumen was divided into two equal parts, and one was subjected to the action of the pancreatic ferment alone, and the other had formaldehyde added. He found five parts of the albumen digested in that which was not doctored. With the other, to which 0·6 per thousand of formaldehyde was added under the same conditions as to temperature and everything, only 1·5 of the albumen was digested.

2620. Have you made a special study of forensic medicine and toxicology?—I have.

2621. Can you give the Committee any instances of harmful results from the consumption of coppered

Dr. J. D. Mann.

24 Nov. 1899.

peas?—That is a question I have devoted a considerable amount of attention to. I cannot give you any direct information. I may say that formerly verdigris, the copper acetate, was regarded as a very poisonous substance. I can remember as a child being taught to regard it as something of powerful potency. Then the pendulum swung back, and until quite recently the toxicological world regarded it as not a poison at all, or, rather, as only a poison in large doses. Now recently experiments have been made, and some observers on the Continent, competent observers, Filehne, for instance, Professor of Pharmacology at one of the German universities, states distinctly that he has produced chronic copper poisoning, which is comparable with the chronic poisoning of the other heavy metals, such as lead. So far there is no very direct evidence, but if I may be allowed to express my opinion, I would distinctly say that copper in peas ought to be prohibited on different accounts. It fulfils no condition except to improve the appearance of the peas. In the case of the food preservatives, you have some grounds, or there may be some grounds urged, namely, that these foods cannot be sold or kept or dealt with unless they are preserved in this way, whereas the copper in the peas does not tend to preserve them in any way, does not add to their flavour, and does not add to their efficacy in any shape or form, but simply adds to their appearance; and, further, copper is not a natural constituent of the body.

2622. Supposing the statement was made to you that copper was a preservative, and that peas to which copper was not added underwent decomposition more rapidly than those to which it was added—what would you say then?—I am supposing that the peas are preserved tinned peas, and that they are preserved in the same way that they tin vegetables generally. In those cases they are not supposed to add any preservative; they do it simply by sterilising and then excluding the presence of air. I am quite prepared to admit that copper or any metal will inhibit the growth of micro-organisms to a limited extent; there is no question about that, but so much the more preservative action you get from the copper so much the more harm would it do to the human being who ate it. I have declined on many occasions to give evidence in these trials. I have been approached with the view of giving evidence in defence of these things, but I have declined, because I think it an immoral thing all round. I certainly could not go to the length of saying the thing in minute occasional doses was harmful, but I could not support it in any way. I have known experts give evidence after living on these peas, for instance, taking them each day at a meal for a week, and then going into the witness-box and saying they were no worse. I do not believe in such evidence one jot.

2623. Have you got any evidence which you can put before the Committee tending to show that colouring matters other than copper are injurious to health—I mean actual evidence?—But what kind of colouring matters?

2624. Colouring matters which in your experience are used for the colouring of one or another food stuff?—I do not think I have any experience except in reference to the copper. That is a toxicological matter; the other colours, the indifferent colours, do not come under my cognisance.

2625. Has chromate of lead ever come under your cognisance?—No. I have not seen a case of chronic poisoning with it. I have seen chronic poisoning in a workman, but that was a different thing—the poison was inhaled, probably.

2626. (*Dr. Tunnicliffe.*) Do you think that under certain conditions in the case, for instance, of formic aldehyde—which is a very powerful antiseptic, and acts in very small quantities—that the addition of formic aldehyde, presuming it is declared, is justifiable in foods?—I do not think it is.

2627. Not when it is declared even?—I should like to draw the line this way: I would like to begin, first of all, by saying I do not think it is justifiable to add any known preservative whatever to milk; that I would be absolute upon. With regard to other foods, I am against it, but any foods which are taken, so to speak, not regularly, and which do not constitute the staple of a person's foodstuff, may be taken at intervals without any harm, I daresay; it is quite possible—I do not want to be too dogmatic about it; but certainly, as to milk, I would object most strenuously to any preservative whatever being added.

2628. Even one part in 100,000?—Yes, in the case of milk. Might I be allowed to say that it has been stated by advocates in favour of it that the conservation of foods by means of ordinary salt is comparable in a way to boric acid? Of course, anybody would know probably that it is not comparable at all, because common salt constitutes one of the chemical ingredients in the human body; it is found in the tissues, and is necessary to the action of the gastric juice; whereas boric acid does not exist normally in the human tissues. Therefore, preservation by these is on two different lines. In the case of common salt the harm that is produced in ham and so forth is simply by rendering the substance less digestible; ham is undoubtedly less digestible than the lean part of fresh meat; but, once digested, then the harm ceases, there is nothing due to absorption; whereas with boric acid we are not sure. I cannot give you direct evidence about it, but it is not a natural component of the human body, and I believe myself, and have believed long before this Committee was appointed, that, especially in poorer neighbourhoods, a lot of the diarrhœa that young children suffer from is not due, as is generally put down, to the milk going sour—I ought to have said, by the bye, in the case where I tested the specimens of milk, that they were not acid; they did not give an acid reaction, and, therefore, the lactic fermentation had not gone on in them—but I believe it is due, in some measure, to the presence of preservatives.

2629. Would you be good enough, if you can, to give the Committee any information with regard to the fact as to whether formic aldehyde is absorbed into the body or not?—That I cannot. It is a substance quite new as regards internal use, and I have no toxicological information with regard to it. It has only recently come into use, and I have no knowledge of its action. Experimentally it has been found to be a blood poison—it converts hæmoglobin into hæmatin, but that is, of course, in large doses, and I am not prepared to say anything about its toxic effects in small quantities.

2630. Would you be prepared to agree or disagree with this statement made by Professor Kunkel, namely that the poisonous effect of formic aldehyde, as far as the higher animals are concerned is small in proportion to its antiseptic efficacy—that is, the passage; perhaps you would like to read it yourself. (*Handing the book to witness*)?—He only says it seems to be in comparison; he does not say absolutely; but "seems to be." I cannot give an opinion because I have no experience.

2631. That is a very definite opinion, would you agree with it, or would you not?—I do not know, I have no means of knowing whether the action of the formaldehyde on the higher animals appears to be slight in comparison with its bacterial action. I presume he means that by the word Bakterienwirkung; but I do not exactly know what he means by Bakterienwirkung. Is it the "action on the bacteria"?

2632. He means antiseptic action, I take it?—I presume so. I am not prepared to answer your question because it is a matter that would require a good deal of experimentation to determine, and I have not devoted any attention to it.

2633. (*Chairman.*) I do not know that we have any other questions to ask you; have you any other point which you would like to add?—I did not come prepared to give a long account; I came rather prepared to submit to examination. That is what I thought probably I should be required to do. I do not think I have got anything that I need trouble you with further.

TENTH DAY.

Tuesday, 19*th December*, 1899.

PRESENT:

The Right Hon. Sir Herbert Maxwell, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. Thorpe, F.R.S.
H. Timbrell Bulstrode, Esq., M.D.
F. W. Tunnicliffe, Esq., M.D.
Charles J. Huddart, Esq., *Secretary*.

Dr. Henry Edward Annett, called; and Examined.

Dr. H. E. Annett.
19 Dec. 1899.

2634. (*Chairman.*) I believe you are a Doctor of Medicine, and that you have a Diploma in Public Health?—Yes.

2635. You are engaged in the University College Laboratory, Liverpool, I understand?—Yes, in the Thompson-Yates Laboratory for pathology; at present I am demonstrator in tropical medicine and tropical pathology.

2636. I think you have given your attention to the study of the result of the use of preservatives in milk?—I have performed several experiments on the use of formalin and boracic acid in milk.

2637. Could you tell us if you have found these preservatives in general use?—I could not say that. I have not taken sufficient samples of milk to be able to tell whether in Liverpool the preservatives are very much used.

2638. But you have found them present in milk?—Yes, I have in a few samples.

2639. Perhaps we had better take the formic aldehyde first; are we to understand that you detected that preservative?—I applied one test, the phloro-glucin test, and obtained distinct evidence of the presence of formalin in a few samples.

2640. What conclusion did you come to as to the action of these agents upon the milk?—I concluded from a number of experiments, which I have recorded in the *Lancet* of November 11th, that formalin, or, rather formaldehyde, in milk in the proportion of 1 in 50,000 had a retarding action upon the growth of kittens to the extent of 29·6 per cent.

2641. Can you tell us what that would be in a quart of milk?—Offhand I could not say. I took five kittens which were just able to lap milk, and four kittens as control kittens. I endeavoured as nearly as possible to obtain kittens of the same age from the same cat in each set; for instance, two kittens out of a number of four from one cat I had in my group, which I treated with this formalised milk, and in the control group I had also two kittens or one from the same cat. In the case of the kittens treated with formalised milk, the average total increase for five weeks amounted to 177·6 grammes, and the average total increase for the same number of weeks in the control kittens amounted to 251·1 grammes, so that the retarding effect upon the growth as estimated by the increase in weight of these kittens amounted to about 29·6 per cent. Then I treated four other kittens with formalised milk, having formaldehyde in the proportion of 1 to 25,000. These experiments were carried out exactly on similar lines to the first ones which I have mentioned. The total average increase for six weeks in the case of kittens treated with formalised milk amounted to 196·6 grammes, and in the set of control kittens to 325·7 grammes. This means a retardation of nutrition amounting to 39·6 per cent. Further, I took another set of five kittens, which I treated with milk having formaldehyde to the extent of 1 in 12,500, and I had a set of three kittens for control. I found that the average total increase for five weeks amounted to 96·4 grammes, and in the control kittens to 312·5 grammes, showing a retarding effect of 69·1 per cent. These kittens were kept under the most favourable conditions. They were not kept in a room such as is generally used for experimental work in laboratories, but they had as much fresh air as they could. They were each kept in a little area which was continually warmed by the sun in the middle of the summer.

2642. Before you go any further I should like to ask you if you have formed any conclusion whether the agent has this retarding effect directly through the digestive tract or by making the substance, the milk, indigestible?—That I have not yet tried. The work of Dr. Foulerton, published in the *Lancet* on December 9th, gives some very important results, showing, with regard to formaldehyde, a hardening effect on blood fibrin, but not on casein; also his experiments seem to show some retarding action on digestive ferments. The only experiment which I have made with regard to the preservative action of formalin leads me to conclude that the proportion of 1 in 50,000, which has been stated to be able to preserve milk for a period of forty-eight hours, is not quite correct. It depends considerably upon the temperature; upon what we might call "contamination," that is, upon the number of organisms present in the milk; and upon the time since the milk was milked. I have found that sometimes in the proportion of 1 in 25,000 formalin will not preserve milk for twenty-four hours and often decidedly not for forty-eight hours at temperatures approaching summer temperatures. The amount of 1 in 12,500 I have found has always been satisfactory for forty-forty-eight hours. After a period of about ten hours since milking I find that at ordinary temperatures, say between 12 and 15 degrees Centigrade, occasionally the proportion of 1 in 25,000 of formaldehyde does not preserve milk for forty-eight hours; and at summer temperatures most decidedly, if added after this period of ten hours since milking, it will not preserve milk for twenty-four hours.

2643. In what quantities did you deal with the milk?—I have used about 100 cubic centimetres.

2644. That, in common parlance, would amount to what?—About one-third of a glassful—a third of a tumbler.

2645. I suppose milk would be less apt to undergo change in larger quantities if the measure was by gallons instead of by ounces?—I could not say.

2646. The surface exposed would be less, would it not?—Yes, the surface exposed to air would be less, but it is a question whether that would at all affect the result.

2647. Will you now tell us the results you obtained from the treatment with boracic acid?—The results from boracic acid have been rather more serious. I treated five kittens with milk containing boracic acid in the proportion of 80 grains to the gallon, and those all died at about the end of the third or fourth week, having become considerably emaciated during the period, having lost considerably in weight. At the same time, of course, I took control kittens. Similarly with milk containing boracic acid to the extent of 40 grains to the gallon, there was again considerable emaciation over a period of three weeks, and they were all dead before the end of the fourth week. Forty grains to the gallon is a little in excess of the quantity generally stated to be able to preserve milk for forty-eight hours; 35 grains to the gallon I think is the quantity.

2648. I suppose the digestion of those kittens was interfered with?—One would naturally infer so; they had considerable diarrhœa.

2649. The balance of nutriment unassimilated was voided, I suppose?—Yes, probably.

2650. I am not quite sure whether you told us whether, simultaneously with treating the kittens with boracic acid, you had other kittens not treated?—I had also control kittens with those experiments; and they, of course, increased considerably in weight.

Dr. H. E. Annett.

19 Dec. 1899.

2651. Now, have your experiments been sufficiently conclusive, in your view, to enable you to come to any opinion on the effect of those preservatives?—I think, no doubt, from consideration of the results one must infer that the presence of those preservatives in milk in the quantities which I have stated must be injurious. I will not say that they must be injurious to adults, but certainly they are to infants.

2652. At all events, in your view it is impossible that the effect should be neutral?—That is so; I think it must be decidedly injurious.

2653. (*Dr. Bulstrode.*) About how much boracic acid were those kittens actually taking per day?—That is exceedingly difficult to say; the kittens were allowed to take as much milk as they wished. A supply was kept up regularly every two or three hours, and it would be extremely difficult, considering the number of kittens which I use—some forty or fifty kittens—to estimate how much each would take.

2654. It is an important point, I suppose you will admit, in relation to the body weight of an infant compared with that of a kitten?—I cannot exactly see that it is important, because the proportions are the same in each case.

2655. (*Chairman.*) Did the control kittens have an unlimited quantity of untreated milk?—Yes.

2656. (*Dr. Bulstrode.*) Roughly could you tell us how much milk was supplied to the total number of kittens; how much milk per day did the boracised kittens have between them?—I should think about a quart a day.

2657. Between them?—Yes.

2658. How many kittens were there boracised?—There were ten.

2659. Ten boracised kittens had a quart of milk a day?—About a quart a day, I should think; I cannot say exactly, of course.

2660. Did you make any control experiments afterwards with the kittens which had been exposed to the boracised milk, or had taken boracised milk; and those which had not been exposed to boracised milk did you treat with boracised milk subsequently?—No, for this reason, that as the kittens grow older they are less susceptible; in fact, they are hardly susceptible at all when they are about three months old.

2661. You did not try that experiment?—No, I did not try that; I did not consider it was necessary. Of course I do not intend to stop here. I mean to go on with a large number of experiments.

2662. Would your experiments agree or differ in any way from those of Dr. Foulerton and Dr. Rideal?—They used animals which were three months old. Kittens three months old are really practically full grown. The kittens which I used were only three or four weeks old; they were just able to lap milk, and in that condition corresponded, I take it, to the condition of infants.

2663. Do you think that the inferences to be derived from your experiments are fairer than those to be derived apparently from Dr. Foulerton's and Dr. Rideal's?—Yes, I think so, their kittens being so much older.

2664. Would you apply the same argument to the results obtained by Chittenden in reference to his dogs?—His also were full-grown dogs.

2665. Then you would not be right in inferring from your experiments the influence which boracised milk might have upon adults?—No, I do not deal with that.

2666. You are simply arguing for the influence which it may have upon infants?—Yes. I do not consider adults at all. I do not think it has much influence; it is a matter of idiosyncrasy, I think, in adults. Since it has been known that I have taken a considerable interest in the question, several medical men in Liverpool have come to me and mentioned cases in which the administration as a medicine of comparatively small doses, ten grains or so——

2667. Three times a day?—Yes, three times a day of boracic acid has caused, during the first day, severe symptoms such as, for instance, the frequent passage of urine. The case I was more particularly referring to was a case of tubercular kidney, where there was the passage of urine every ten minutes or quarter of an hour, with severe pain.

2668. How far do you think an inference as to the human species is justifiable from results obtained on kittens?—I think considerably, because kittens are practically absolutely dependent upon a milk diet at this age—three to four or five or six weeks.

2669. Could you point to any other cases in the animal kingdom where apparently animals having the same sorts of food are absolutely insusceptible, say, to anthrax?—No, I do not think I could.

2670. Do you know the susceptibilities of house mice and some other mice to anthrax?—Yes, certainly.

2671. Do you press the point far as regards this influence on kittens?—Most decidedly.

2672. You do?—Most decidedly.

2673. Would you tell us with regard to the work of other investigators on the subject, what you regard to be their fallacies?—The first I made mention of just now, namely, the action in animals. Other investigators have taken dogs and cats, and guinea pigs and rabbits, and so on—they have not taken young animals, which correspond to infants. Secondly, with regard to the action on ferments of those preservatives—their experiments have all been in vitro. I think considerably more evidence could be obtained if the experiments were performed on young animals. I can easily conceive a number of experiments which might be done in this direction. In regard again to the action on ferments, these experiments which have been recorded by Foulerton, Chittenden, and so on, are experiments on a ferment separated chemically: the freshly secreted ferment is admittedly much more sensitive, and much more active. Even Foulerton in his experiments recorded in the *Lancet* on December the 9th, I think, as the result of his experiments, states that the action was much more decided in the case of more active ferments.

2674. You would rather rely upon the results as regards general nutrition or malnutrition than upon experiments conducted *in vitro*?—Decidedly; until we can obtain some idea of the results in the animal body.

2675. In your article in the *Lancet*, on November 11th, you say that it is possible to conceive that the infantile mortality rate from diarrhœa is maintained by "doctored" milk?—Yes.

2676. What is your direct evidence as to that?—My direct evidence is, first, the result of Dr. Foulerton's experiments on the ferments and on the digestibility of proteid matter which has been submitted to the action of these preservatives; and secondly, my own experiments on kittens. I think that the presence of a preservative may account directly for the large infantile mortality from diarrhœa in large towns, or it might produce such a condition of the digestive tract as to make possible the multiplication of a specific organism if such is present in infantile diarrhœa, and would conduce to such conditions of the infantile tract that this organism may grow luxuriantly.

2677. Am I to understand that you think it possible that the infant mortality in towns may be due to this comparatively modern habit of preserving milk by such preservatives as you have experimented upon?—Yes, I think it possible.

2678. Do you know anything as to the history of diarrhœa in years gone by, before these preservatives were introduced?—I do not know very much; but has one any evidence as to how long, for instance, boracic acid has been used in the preserving of milk?

2679. Are you aware whether in the last thirty years there has been a rise in the infantile mortality rate from diarrhœa?—I was not aware of that.

2680. If your thesis were true, should you expect it to be so?—I should expect it to be so, I think.

2681. Your experiments would go to show that it is important, even supposing the use of preservatives were not interfered with, that the preservatives should be added directly the milk is drawn, and that you require more preservative when the multiplication of bacteria has taken place?—Yes, when the milk is older.

2682. Have you made any investigations as to the bacteria contained in one and another specimen of milk which you have experimented with?—I have not yet had time. I am still carrying on a piece of work of that nature.

2683. Could you tell the Committee anything as regards the decomposition of milk, and whether you consider the lactic acid changes may be taken as an index of all that is going on?—I do not think the indications given by lactic acid, that is, by the acidity of the sample, are really a just indication of the decomposition of the milk.

Dr. H. E. Annett.

19 Dec. 1899.

2684. But you have no evidence to put before us as to that?—I have no complete evidence. I have only examined a few samples in that direction as yet.

2685. May we ask what your general conclusion would be as regards we will say, administration—as to whether, for instance, your inference is that the use of such preservatives as boracic acid and formaldehyde should be prohibited altogether?—My opinion is that they should be strictly prohibited for these reasons: First, milk can be preserved by other methods, as you know (by cold, by sterilisation processes, pasteurisation, and so on), secondly, the use of preservatives in milk would admit of the manipulation and keeping of the milk in insanitary conditions; for instance, it would permit uncleanliness among the cows, uncleanliness in the person milking, uncleanliness in the vessels, uncleanliness in the sanitary conditions of various milk houses, and so on; further, it would permit of the sale of a milk already well advanced towards the sour condition, in which condition it is admittedly injurious to health, especially in the case of infants.

2686. Have you evidence to show that the addition of say, boracid acid, will veil the decomposition of milk?—I have no evidence whatever of that.

2687. We have had considerable evidence in that direction, that it is not possible?—That it is not possible to veil it?

2688. That once decomposition is set up you cannot veil that decomposition, although you may inhibit it?—No, I do not think you can veil it.

2689. I interrupted you, I am afraid?—You were asking me about my opinion as to whether the use of preservatives should be strictly prohibited; from the results of experiments on ferments, and from the results of my own experiments, I think that the presence of a preservative in the milk by reason of its action on ferments and proteids, for instance, would severely tax the delicate resources of infantile digestion, which might be already considerably taxed by the use of artificial foods and the lack of human milk, the natural infant food.

2690. (*Dr. Tunnicliffe.*) I should like to get one point quite clear; that is with regard to the amount of boracic acid that each kitten consumed; you cannot give us any accurate information with regard to that, I think?—I am afraid I cannot.

2691. Then I take it that you explain the difference between your physiological results and those of other observers by the earlier workers having used adult and not immature animals?—Did you call them immature?

2692. Yes; that is the way you explain the result?—Yes. It is the term "immature" that I do not quite exactly like.

2693. I meant that they worked on adult animals?—Yes, my whole point was to have for the experiments animals which corresponded to the human infant, that is, animals of the age and animals of the susceptibility of human infants.

2694. You told the Committee that at three months cats became apparently immune to the action of preservatives?—Yes.

2695. Is that change a sudden change, or is it a gradual change; can you give us any evidence upon that?—It is a gradual change, as is seen from my results. As the kittens grew older the weekly diminution in weight decreased, whereas cats or kittens, whatever you call them, three months old, would suffer no harm, they would be immune. So I conclude it is a gradual process of immunity.

2696. You can draw no conclusions from those results with regard to the time so far as concerns the answering immunity in the human infant?—No, that I could not.

2697. (*Professor Thorpe.*) I should like to ask Dr. Annett a question relating to what his idea is as to the specific action of these preservatives; do they act by inhibiting the action of enzymes or other fermentative agents in digestion, or have they a specific action of their own apart from them?—Of course one cannot say definitely; one has to simply take the results of experimental work. No doubt there is an inhibitory action upon the enzymes, but the experimental work is rather confusing. For instance, the action of boracic acid and borax and of the boric mixture is stated by different observers to be "favourable," "decidedly favourable," or "unfavourable," and "decidedly unfavourable." The results are completely muddled, especially in the case of gastric digestion; there seems to be considerably more unanimity in the case of pancreatic digestion in the action of boracic acid and borax both on pepsin and on amylopsin, the two ferments in pancreatic digestion.

2698. What is the inference from the circumstance that in the case of a kitten, as I think you said, at three months old, the preservatives in the proportion that you have given to us seem to have no specific action; how do you interpret that?—I do not quite understand your question.

2699. How do you interpret the fact that, say, after three months the kitten appears to be immune to the action of these things?—That I cannot explain, unless there is some other action of preservatives upon the secreting epithelium of the intestinal tract. Of that we have no experimental evidence, and it is difficult to get.

2700. Is there anything which leads you to suppose that the animal adapts itself to the condition when it becomes immune, as it does, by the administration of many other poisonous things?—I cannot say; I cannot give any evidence whatever upon that.

2701. There is no evidence on it?—No.

2702. (*Chairman.*) Have you any other statement, either general or particular, that you would like to make?—The only other thing on which I would like to make any remark is an observation of Dr. Cameron's, I think. He said that he found in the case of condensed milk that two samples out of three had been treated with boracic acid. I think he is recorded as having mentioned that in evidence. That seems to me rather an important fact, considering the extent to which condensed milks are used as infant food among the lower classes. I think that is all I have to say.

2703. On the point raised by Professor Thorpe as to the apparent immunity of kittens at three months old which have been fed on boracised milk, have you made any experiments to ascertain whether kittens normally fed up to the three months are also immune on reaching that age?—No, I have not.

2704. You have told us that the kittens treated with "doctored" milk recovered, or, at all events, became immune at three months old?—Yes.

2705. Would kittens which had been fed on pure milk up to that age show the same degree of immunity?—I did not make any experiments in that direction myself, but Dr. Foulerton has already recorded that he made experiments on three kittens at three months old with boracised milk, and obtained no results whatever.

Professor ROBERT BOYCE, called; and Examined.

Prof. R. Boyce.

2706. (*Chairman.*) You accompany Dr. Annett, I think?—Yes.

2707. You are Professor of Pathology in the University College, Liverpool?—Yes.

2708. And also one of the Public Analysts for the City of Liverpool?—That is so.

2709. I think you had a prosecution this year by the Corporation against a milk dealer for selling milk containing formalin?—We had, and we gained our case.

2710. Previous to that had you directed much attention to the use of preservatives in food?—Before that period I had not directed my attention to the subject; it was that which caused my attention to be directed to the subject, and also the attention of the Medical Officer of Health. He asked then for experiments to be made in that direction, and Dr. Annett undertook them.

2711. What are the principal preservatives with which you have experimented?—The preservatives which I have seen used are formaldehyde and boracic acid. I now allude to the experiments which were conducted by Dr. Annett.

2712. You have heard what Dr. Annett has said, I think?—I have heard his evidence.

2713. Have you anything to add to that?—There are some points which I would like to emphasise which he brought out in evidence. First, the importance of experiments on living animals to determine the action of preservatives, and especially the importance of selecting

Prof. R. Boyce.

19 Dec. 1899.

those animals which conform in their metabolism as nearly as possible to ourselves, and the importance of selecting them at a suitable age. Therefore I think that the selection of young kittens just after they had left the breast was the most suitable. Selecting dogs, or, as has been done, guinea-pigs, above all animals, to conduct a series of this class of observation upon, I think, is almost worthless.

2714. Would you tell me as one wholly ignorant of comparative anatomy why a kitten, in your opinion, is the best animal?—Comparing it with a rodent, if I might, in the first instance I think it is much more suitable than a rodent because its digestion is more like our own. Then there is the class of food that it takes—a rodent feeding on grain and vegetables, and a kitten, of course, taking milk and, subsequently, meat.

2715. A cat is purely carnivorous?—That is so.

2716. But a human being is not so?—That is so; but I mean that in the earlier stages, in the infant stage, I think, our food very closely approximates.

2717. I have heard a rough analogy drawn sometimes —I have no doubt I betray my ignorance when I mention it—between a human being and a pig; is a cat nearer to a man than a pig?—I should say that young sucking-pigs also would be good animals to experiment upon—again because of the nature of and the way in which they take their liquid food. Rodents do not take liquids in that way. Then, further in support of the usefulness of experiments on animals like cats I would mention that it has been found over and over again in the physiological laboratory that experiments conducted upon cats and dogs throw a very great deal of light upon physiological processes taking place in man. Therefore, the cat and the dog are the two animals that are the most commonly used for those experiments that are undertaken to illustrate processes going on in man, in preference, that is to say, to the rabbit or the guinea-pig.

2718. But, on the other hand, certain rodents are susceptible to diseases affecting human beings to which cats and dogs are either not susceptible, or if they are, in a much less degree; is that not so?—You are right; that is so.

2719. Tuberculosis, for instance?—Tuberculosis is more prevalent in the rodent, but it also does occur in dogs and occasionally in cats.

2720. It is exceedingly rare in them, is it not?—It is rare. I was going to remark that the conditions under which these animals are kept were the very best possible, and I think that is a matter of very great importance; furthermore, I have observed these kittens for half an hour at a time, and even longer in their cages, and I have observed that they had a repugnance to the food; the two dishes of milk were put into the two cages; the kittens in the beginning took the formalised milk and the non-formalised milk with equal avidity, but after a certain time there was unquestionably a change—it was either a falling off in appetite for the milk, or it was that the milk had not the same attractive appearance as ordinary undoctored milk. I only mention that as an observation which rather struck me at the time, that it was not so appetising. I will put it that way, that the formalised milk did not appear to be so appetising as the ordinary milk.

2721. (*Professor Thorpe.*) Would that be because the odour of the formalised milk would eventually repel the cat?—I noticed the same effect also in connection with the boracic acid milk.

2722. (*Chairman.*) In your opinion, it arose from the animals not being so robust?—That would rather, I suppose, be really the true explanation—that they were tending to lose their appetite, but I noticed that it did not occur in the beginning so much as towards the end.

2723. Was there sufficient formaldehyde to flavour the milk perceptibly?—I never took it.

2724. After watching these experiments you have come to the conclusion that the presence of formaldehyde in milk is injurious to the consumer at that stage?—I have.

2725. Even in such a small proportion?—Even in such a small proportion.

2726. Have you compared the results arrived at by Dr. Rideal and Dr. Foulerton?—As regards the experiments on animals I have. I am not surprised that they have obtained the results they have, using the animals that have been already described; I consider those animals were too old.

2727. Now, as to boracic acid, were the phenomena similar to those you have already described with regard to formaldehyde?—Quite similar.

2728. Greater or less in degree—more or less marked, I mean?—I thought that in the boracic acid experiments the action was more marked than in the case of formaldehyde; the appearance of the animals was very marked.

2729. I think you have made some enquiries on the Continent as to the use of these preservatives?—Yes.

2730. How are they dealt with there?—I have tried to gain information as regards whether analyses were conducted for determining the presence of either formaldehyde or boric acid in milk. In the laboratories which I visited I found I could obtain little information upon that point; the only boracic acid determinations which they apparently made in food stuffs were made in the case of preserved meats—hams. On the action of boracic acid from a physiological point of view upon the mucous membrane of the intestine they apparently had no experiments. I visited in that connection, I might say, the Gesundheitsamt, in Berlin; and they mentioned the fact that they themselves were continuing a series of feeding observations with boracic milk.

2731. (*Dr. Bulstrode.*) I do not quite gather whether the kittens became quite immune to preservatives such as were used when they were three months of age or whether they only became relatively immune?—I think it is this way, that the animals become immune owing to the continued repetition of the doses—they become thereby to a certain extent immunised. I say that because we have experience that immunisation can be brought about in that way; also there is the natural immunity, which begins to get strengthened as the animal increases, so that at the end of three months, apart altogether from its having been dosed with boracic acid it would have at that period a certain amount of natural immunity. That is why Dr. Annett said that the experiments of Rideal and Foulerton upon animals of that age are practically not so instructive as experiments upon animals of a younger age.

2732. Then might we, do you think, provisionally, state from the result of Dr. Annett's experiments and yours, and those who have worked with adult cats and dogs, that infants are likely to derive harm from taking milk so dosed, but that adults are not likely to derive harm; would that meet the case so far as your experiments go?—The first portion of the statement would meet the case, but I would not in my present state of knowledge accept the second portion of the statement, which would be practically that older animals or older human beings would be insusceptible.

2733. Not, of course, your own experiments, but the results of Chittenden seem rather to show that the dogs took considerable amounts with immunity; therefore, the inference from that is that with adults no harm may accrue?—Yes, I think that would be undoubtedly the fact.

2734. (*Chairman.*) You are speaking of dogs in the normal state of health?—Yes.

2735. (*Dr. Bulstrode.*) If this immunity can be produced by the exhibition of repeated doses of boracic acid, would you see in that an argument against allowing the use of preservatives?—I would indeed, because it has been gained at a great deal of expense to the infant—I most assuredly would.

2736.—Apart from that, would you see any other argument?—That seems to me to be the chief reason; I do not think, apart from that, that there is any other.

2737. Do you think it is fair upon the medical man that a patient shall be made immune to a drug without his knowledge—boracic acid as you know is used largely in certain diseases?—Yes, I do not think it fair on the patient.

2738. Or the medical man?—Or the medical man.

2739. With regard to your visits abroad—you went into Belgium and into Germany I think?—Yes.

2740. In Belgium did you ascertain what the law as to the use of preservatives was?—I visited Professor Bergé at the municipal laboratory, and tried to ascertain from him some definite facts relative to the laws on food preservatives, but I could not gain any definite information. Apparently they make no analyses of boracic acid in substances like milk—and milk was the food substance which was running through my head in all my conversations with these foreign municipal chemists.

Prof. R. Boyce.

19 Dec. 1899.

2741. Do you know that the use of preservatives is prohibited by law in Belgium?—Quite so; we found that in several places. I think also in Germany that the use of those preservatives was prohibited, but a case had not arisen for prosecuting; it never had occurred to them to analyse for a case of boracic acid in milk as far as I could ascertain.*

2742. You had no reason to believe that the law, although in force, was carried out?—I had no reason to believe the law was carried out. I had no evidence whatever of that; I think I would have been informed had the law been carried out.

2743. Did you get any indication that preservatives were used?—Only in connection with American meat.

2744. Did you go into Austria?—I went into Austria.

2745. Do you know that the use of preservatives such as salicylic acid and boracic acid is prohibited there?—I am under that impression, but I do not think I made a note of it at the time.

2746. Did you go into Switzerland?—No.

2747. Have you made any experiments as to the growth of bacteria in milk?—I formerly made a considerable number of experiments upon the multiplication of bacteria in milk at different stages after it has been drawn from the cow.

2748. Have you made any experiments in that connection after the addition of preservatives?—No, not after the addition of preservatives.

2749. Might we ask for a few of the facts which you ascertained in those experiments?—In my experiments I found that immediately after drawing the milk with a sterilised vessel, the number of bacteria were, say, 200; but by keeping the number of bacteria multiplied at, of course, an exceedingly rapid rate, that was before any souring had occurred, so that milk which appears fresh, as is well known, contains a very large number of bacteria.

2750. (*Chairman.*) Are you speaking of bacteria in general?—Yes, in general. More recently I have been conducting experiments to ascertain the proportion of what may be regarded as pathogenic bacteria in milk, namely, upon the presence of the bacillus coli, and of the bacillus enteritidis sporogenes. I find again that in milks which appear perfectly sweet those two organisms may be present in considerable numbers. I would point out that the bacillus enteritidis sporogenes is a spore-bearing organism, and therefore would resist very considerable quantities of disinfectants. So that as regards the pathogenic bacteria which may be present in milk, although formaldehyde or boracic acid might to a great extent inhibit the growth of the simple bacteria, its chances of inhibiting the growth of an organism like the bacillus enteritidis are remote, or at any rate it would be required in such a large quantity as to make the presence of the formaldehyde objectionable to the senses.

2751. (*Dr. Bulstrode.*) Have you used formaldehyde for preserving bacteriological specimens?—I have a long time ago. I am using it, of course, in large quantities every day; I use, I think, something like 100 litres of formalin in the course of the twelve months. I am well acquainted with its irritant action on the mucous membrane of the eye, and on the mucous membrane of the nose. That is why I think, in answer to a question of Professor Thorpe's, that the action of formaldehyde is inhibitory, and that it has a direct action upon the cells of the nature of an inflammation. It tends to lower directly the vitality of the cell; it would tend therefore to stop secretion for example; that is, it has a direct action upon the enzyme producing cells, and also affects digestion indirectly by acting upon the foods.

2752. (*Professor Thorpe.*) Perhaps Professor Boyce is able to tell us something more as to the difference between the action of boracic acid and formaldehyde?—I could hardly throw light that would be at all useful upon that matter. All I can say is that in my experience formaldehyde is exceedingly irritating—directly irritating—and that my laboratory boy, who works with the formaldehyde, is sometimes thrown out of work—incapacitated from work—by the action of the formaldehyde on the mucous membrane of his eyes. Now, I have taken boracic acid myself, and I have not experienced any irritating action direct from boracic acid; so, therefore, as regards the question of irritation I would say there is a very marked difference between formaldehyde and boracic acid.

2753. But your laboratory boy would be equally irritated by emptying a Winchester quart of strong ammonia into the various laboratory bottles, but you would not infer from that that the minute quantities of ammonia which might be, say, in a natural water would necessarily influence anybody drinking such water?—Ammonia in a sufficient quantity in the atmosphere to cause irritation of the eyes, I should say if taken in the same proportion in a fluid would cause equal irritative symptoms internally.

2754. Yes, but the formaldehyde in milk is never taken in anything like such comparable proportions?—As the simple attenuated vapour that one gets by simply lifting out of or putting a specimen into a jar containing very dilute formaldehyde. Its dilution in the atmosphere under those circumstances must be exceedingly small, yet it is exceedingly irritating.

2755. There are many other irritating vapours which are not otherwise pernicious; I think it is rather straining logic to say that because in handling a thing like formaldehyde you suffer great inconvenience in the mucous membrane—which, of course, we all know—it necessarily follows that because you drink it in an extremely dilute condition that it ought to produce an analogous effect?—Perhaps that is so, but at the same time it indicates the probable action of the drug.

2756. (*Chairman.*) Is the vapour from formaldehyde pungent or perceptibly irritant?—It is irritant, and quite perceptibly irritant. It has a curious characteristic odour; it is not like ammonia exactly. Might I also point out, as a matter of experience of irritation from ammonia, from formaldehyde, and from osmic acid, that the action of the vapour of formaldehyde and of osmic acid, is much more persistent than the action of ammonia. These latter are more pungent in their action. With formaldehyde, I know in the case of my own nose that the action persists in the mucous membrane for a very long time, whilst it does not with ammonia—with ammonia the after reaction is rather refreshing.

2757. (*Professor Thorpe.*) That depends on the ammonia. I suppose you have never been immersed suddenly in a very strong atmosphere of ammonia?—No, but I am expecting it every day with our ammonia refrigerating plant.

2758. I will take you on another subject. You are one of the public analysts of the City of Liverpool?—Yes.

2759. Would you kindly tell the Committee the precise relation in which you stand to your colleague the other public analyst?—Yes; we stand in quite friendly relation for this reason——

2760. I was not speaking about that. I mean what are your official relations?—Quite so, and it was rather to explain that point. I am charged alone with the bacteriological analyses, whilst he is charged with the chemical analyses; I do no chemical analyses, he does no bacteriological analyses.

2761. As a public analyst I presume you are concerned in prosecution cases occasionally, and you know what goes on?—Yes, that is so.

2762. You are in occasional attendance, I suppose, at the police courts?—Yes, but only under special circumstances, where my evidence might be useful in connection with the presence of pathogenic organisms as a danger in foodstuffs.

2763. Your experience, I take it, has been sufficient to enable you to express opinions as to the working of the Food and Drugs Act?—I should hardly say it is; my experience is quite new, and it is so special; it has altogether to do with organisms in food stuffs. I have confined my attention wholly to that aspect of it.

2764. Would you feel justified, do you think, in expressing any opinion as to the practical effect of the working of a statement that a milk seller would have to declare that a certain sample of milk contained preservatives?—I mean, do you see any practical difficulty in the carrying out of such an enactment, supposing it were to be made?—There would be naturally a great deal of difficulty, but I think there would be no insurmountable or practical difficulty in carrying out such a line. I think it would be good that such a stringent regulation should be made, especially in view of what Dr. Annett has said of the state of perfection of other means of preservation.

2765. Of course, what I was immediately indicating does not necessarily prevent the use of boracic acid, or of any other preservative; it merely throws the obligation

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* In Hamburg, I have subsequently learnt, numerous analyses had been made for the presence of boracic acid and other preservatives.

Prof. R. Boyce.

19 Dec. 1899.

on the person vending it to declare that these things are there if they are there; would there be any difficulty in carrying out that?—I do not think so.

2766. Do you think that would be a sufficient precaution?—Namely, that the milk vendor should declare when his milk contains boracic acid or does not contain boracic acid? I take it that that is what the substance of your question is?

2767. Yes?—I think that could be practically carried out, and would solve a great deal of the difficulties.

2768. Do you imagine that would throw such a duty upon the local authority that they could not possibly overtake it?—I do not think it would throw such a very great onus upon the local authority, and it throws a very great onus on the vendor to advertise his milk as containing boracic acid; but a very few prosecutions would tell where the boracic acid was used.

2769. (*Chairman.*) Would you extend the obligation to vendors of patent preservatives, such as glacialine?—Yes, indeed.

2770. You would oblige them to declare the components of the mixture?—Certainly.

2771. (*Dr. Tunnicliffe.*) With regard to what you have said concerning the irritant action of formaldehyde, are you aware of the fact that at Schering's manufactory where formaldehyde is made no cases of irritation are known?—I can only say that that argues well for the system of ventilation, and so on, that they adopt at that factory; and I can quite believe it, because it is such a modern up-to-date factory.

2772. (*Dr. Bulstrode.*) Did I understand you to say that you would be content if the produce of the preservative in various food stuffs was stated?—Needless to say, I would much prefer to see it ruled out altogether and prohibited.

2773. But apart from that?—Apart from that I would then agree with compelling the sender to state the nature of his foodstuff.

2774. How would you propose to limit the amount? That would still leave a free hand as regards amount?—It would leave a free hand as regards the amount, but I do not think it would lead to the increase of the amount, because where formaldehyde increased the milk would be unsaleable.

2775. Take boracic acid?—In the case of boracic acid, it would be certainly very much more difficult, and I can see a very great difficulty in the case of boracic acid.

2776. Do you think it is right that people should go on taking a drug which they are not aware of?—I do not think it right; I think that is the whole point; it would be very harmful. My only reason for supporting such a method of procedure is that I do not think the milk vendor would, under such circumstances, employ disinfectants, which doctors would say were inimical.

2777. (*Dr. Tunnicliffe.*) Do you think if experiments were to be made upon a larger number of animals than appear to have been attacked by Dr. Annett, and one got results similar to his, that would be sufficient evidence to preclude or to prohibit the use of preservatives in milk?—I think that would be sufficient evidence if experiments were continued upon those lines in the way that you suggest.

2778. You have no experience of any experiments made on other immature animals than kittens, have you?—No, I have no further experience of experiments than those of Dr. Annett and Dr. Rideal.

2779. Suppose it so resulted from those experiments that kittens were affected by boracic acid, and that, say, for instance, monkeys or sucking pigs were not affected; what course would you then suggest should be adopted with regard to the formulation of conclusions?—I would be more inclined to base my conclusions upon the observations upon the kitten—an animal with which we are much more familiar than other animals.

2780. Then, I take it that you think the kitten is sufficient in itself?—I take it that the kitten is sufficient.

Dr. R. Bell.

Dr. Robert Bell, called; and Examined.

2781. (*Chairman.*) You are a Doctor of Medicine, and a Fellow of the Faculty of Physicians and Surgeons, Glasgow, I believe?—I am.

2782. Also a member of the Royal College of Surgeons, Edinburgh?—Yes.

2783. I understand that you have had a long experience in the administration of borax and boracic acid?—I have.

2784. In surgery or in medicine, or in both?—In both.

2785. I think you are aware of the subject of our inquiry; can you give us any information which will throw light upon the effect of boracic acid?—Do you mean medicinally and surgically?

2786. Medicinally, inasmuch as what we want to find out is its effect upon the human constitution?—I am perfectly certain that it has no bad effect upon the human system. I have never given it in enormous doses, but in moderate doses it has a most beneficial effect. May I give one or two instances?

2787. If you please?—There is an old gentleman in Glasgow, a very well-known man all over the country, whom I have been called in consultation to see several times within the past four years. He is over 80 years of age. About four years ago he was suffering from putridity of the urine, which very soon would have produced blood poisoning and sudden death. I advised the medical man in attendance to give him ten grains of boracic acid three times a day, and to have the bladder washed out with a saturated solution of boracic acid, with the effect that in a few days the putridity of the urine had completely disappeared. Since then he has been taking boracic acid regularly for four years at the rate of 30 grains a day with the greatest amount of benefit. If he had not had boracic acid I am perfectly sure he would have been dead four years ago, so that he has been kept alive practically by boracic acid. That is a very extreme case, because he is the oldest patient that ever I treated with boracic acid; but I have treated scores of cases of ammoniacal putrescence of the urine and even of pus in the urine frequently with boracic acid, and I have never found the slightest bad effects, but have always found beneficial effects. For the last eighteen years I have been a director of the Glasgow Dairy Company, and on my advice we have been employing boracic acid for keeping the milk sweet. My own family have taken it during the whole of that period, and we have never had a single case of illness in the house; when scarlet fever, measles, whooping cough, and other ailments were rampant there was not a single one of our children taken ill. There is another family that I know very well in the same position as ourselves. I do not say the boracic acid did it, but we have always—my own family and the family of a particular friend of mine whom I have watched carefully and to whose house I go very frequently—taken this milk for the last eighteen years, and we have always enjoyed the very best of health. I knew a gentleman in Glasgow, a large manufacturer of borax—he is dead now—who for years and years never had a piece of borax out of his mouth; he was constantly sucking borax, and certainly he would take a couple of ounces every day, swallowing the borax in that way.

2788. Are you of opinion that boracic compounds are of such a nature that the community at large should be allowed to consume them without being aware that they are doing it?—I think it is so innocuous that they might easily be allowed to consume it without injury to them in any way whatever.

2789. Take the case of your patient that you have just mentioned; you prescribed 30 grains a day?—Yes.

2790. If in addition to that he had been taking ten grains more in his food unknown to himself, would there not be a risk of an overdose?—No, I am perfectly certain there would not.

2791. Do you think the amount that may be taken into the system is unlimited?—Of course I have never given it unlimitedly, but I would have no hesitation myself in taking 30 grains three times a day. I cannot see where boracic acid can do any harm. It has no noxious effects that I could possibly ascertain. It is not nearly so noxious as saltpetre or common salt. I am perfectly sure that if you were to take saltpetre or common salt in the same amount you would do very much more harm to the system than you would by taking boracic acid in the small quantities that you do.

2792. Is not the difference this—that in the case of salt and saltpetre you cannot take them unawares, but you must know what you are taking?—I suppose a person taking a ham preserved by saltpetre would know that he was taking it by the disagreeable taste, and by the effects upon his throat—by its producing excessive thirst.

2793. That being your opinion, founded on experience, I suppose we may assume that you do not see any necessity for causing traders using that preservative to notify its presence?—No, I do not. Might I give one other instance which has just struck me at this moment? About four years ago I happen to have been engaged in a very important surgical operation—a very serious one—where I removed a very large tumour from a woman. The tumour weighed 58lbs., and the pedicle was an enormous pedicle, about as thick as my wrist. Of course, I had to treat that outside the body. I simply put pounds of boracic acid over that pedicle, over that raw surface, and if it had not been for that I am certain that woman would have died from blood poisoning, but she got quite well. There was a large absorbent surface there; that boracic acid was put on, not by spoonfuls, but I should say by a quarter of a pound, or half a pound at a time, and then cleared away, and a fresh quantity put on every day. We must have used seven or eight pounds of boracic acid during the treatment of that single case, and there was not the slightest effect upon the system.

2794. Though several grains would pass into the system?—There must have been a great deal of absorption, and you can imagine that a woman in that state of health would be susceptible to any injurious treatment. She was reduced; she only weighed seven stone herself. The pedicle separated without the slightest putrescence. That is the most extreme case in a surgical way that I have ever had to do with, but I remember quite well that we just simply got seven pounds of boracic acid, and put it by the handful on to the pedicle.

2795. Have you made any experiments with other preservatives?—No; I am quite satisfied with that one.

2796. (*Dr. Bulstrode.*) You say you have never known any ill-effects to arise from such absorption; does that mean that in your experience you have never known them, or that you have not heard of them?—I am only speaking of my own experience; I have heard of statements, which I did not believe, frequently.

2797. Are you aware that the statements are fairly widely prevalent in the medical profession?—I do not think they are widely prevalent; there are a few isolated cases, but I have never heard anything like a unanimous opinion, or even that a considerable number deprecate the use of boracic acid, because it is used so very largely in surgery by the most eminent men, especially in cases of bladder disease. We know quite well that men use it for years and years themselves to wash out the bladder.

2798. Do you know this book on "Forensic Medicine and Toxicology," by Dixon Mann?—No, I do not; but I think I have seen the paragraph you are referring to just now.

2799. Might I read you this: "Fatal poisoning has followed the injection of solutions of boracic acid into natural and into abscess-cavities of the body. Molodankow relates two such cases. In one a 5 per cent. solution was injected into the pleural sac on account of an empyalmia; vomiting occurred, and the pulse was small and weak. The following day erythema appeared on the face, and spread over the body; and the third day the patient died. The second case was that of a boy, who, half-an-hour after having an abscess-cavity washed out with a boracic solution began to vomit, and to be collapsed; erythema and hiccough occurred on the second day, when he died. . . . . . Three fatal cases from washing out the stomach with a solution of boric acid are recorded by Hogner." Are you aware of those cases?—No. I am quite aware of that now, but I can quite easily conceive that if that were washed out with plain water it would have the same effect, because the cases were very serious in themselves.

2800. Do you know that in the "Lancet" of January 7th, Dr. Wild, of Manchester, reported a considerable number of cases in which bad results had apparently accrued from the exhibition of boracic acid?—Which results were erythema.

2801. Erythema and death—erythema frequently, and other conditions such as diarrhœa?—Do you mean that they were subsequent to the administration of boracic acid? It does not follow that boracic acid was the cause of death.

Dr. R. Bell.

19 Dec. 1899.

2802. I mean there were many cases under different medical observation, and in the opinion of those who had connection with the cases the two were connected in the relation of cause and effect; however, you were simply taking your own experience?—I am taking my own experience, which I prefer.

2803. Could you tell us why the dose of boracic acid in the British Pharmacopœia was cut down by 50 per cent., or more than that—100 per cent.?—No.

2804. Do you know that it is the fact?—No. I never go by the Pharmacopœia in a case of that sort, because I think it is purely empirical.

2805. Would you think that if the British Pharmacopœia cut down their dose from 10 to 30 grains to from 5 to 15 there might be some reason for it?—Of course, 5 to 15 is quite ample; 10 to 30 would be too large in almost any case; 10 grains is quite sufficient to produce the effect.

2806. To produce what?—A medicinal effect.

2807. Do you say 10 to 30 grains would be too large?—I think it is quite sufficient, and you do not need any more. We always find 10 grains three times a day is quite sufficient to correct any state of decomposition of the urine, which boracic acid is principally given for.

2808. Are there any conditions in which you would not administer boracic acid?—None.

2809. We have been told that in nephritis it is undesirable to administer boracic acid?—I do not think it would be; I would give it in nephritis at once.

2810. You would?—Yes.

2811. You see no danger in the public being exposed to the chance of taking unawares 50 grains of boracic acid a day?—So far as my experience goes there would be no danger; but I think it would be perfectly absurd to give anybody 50 grains a day; there is no necessity for it.

2812. I gather from you that you do not see any necessity to prohibit the use of boracic acid as a preservative?—No, I do not, certainly.

2813. Then if I tell you, as a fact, which you can verify, that it is possible to take unawares as much as 50 grains in a day, would that lead you to alter your opinion?—I cannot say that 50 grains would do any positive harm, but I think it would be absurd to give it.

2814. If I tell you that it is being given possibly daily—that it has been given unawares, in foodstuffs—would you still say that there is no need to prohibit the use of boracic acid in food?—I would not take an isolated case of that sort, and say it should be prohibited. I think it should be permitted. My opinion is that boracic acid does a great deal more good than it does harm.

2815. (*Chairman.*) May I ask if you are talking of adults, adolescents, or infants?—I am giving you the adult dose.

2816. (*Dr. Bulstrode.*) Do you think there is any risk of a child being subjected to a dose of, say, 40 grains of boracic acid?—I would not be inclined to give it, because it would be unnecessary. I would not say it would do it any harm, because I have never tried it; but I do not see how a child can get 40 grains of boracic acid.

2817. Suppose I tell you that as much as 26 grains of boracic acid have been found in a pint of milk, would that lead you in any way to modify your opinion as to the use of preservatives?—No, it would not, but I think it would be gross carelessness to put that in.

2818. Would you not like to see some system for regulating that carelessness, and preventing that carelessness?—Somebody has been trifling with the food, somebody has been meddling with the food, if you have 40 grains put in, as a preservative, because it is such an enormous quantity to be put in to act as a preservative.

2819. With regard to saltpetre it is not used, I take it, as a preservative in milk?—I should say not; it would spoil the milk.

2820. You speak in your précis of curing bacon with boracic acid. Do you know anything as to that?—Yes.

2821. Could you tell the Committee what you know as to the curing of that?—I know that 0·6 per cent. of boracic acid is quite sufficient to produce mild cured bacon of a very palatable and a very wholesome description, and very much better for the stomach than if it had been cured in the old-fashioned way by nitrate of potash and common salt.

2822. Do you know how it is cured—I mean what the method of curing is, where boracic acid is used?—I

Dr. R. Bell.

19 Dec. 1899.

really do not know the practical details, but I know it has been suggested to inject a solution of boracic acid immediately after death. Whether that has been done or not I do not know. I think it must be cured by steeping the carcases in a solution of boracic acid.

2823. You have got no information?—I have no practical information on that point, but I know that 0·6 per cent. has been found sufficient to preserve hams.

2824. (*Chairman.*) There is one answer I should like to get clear on the notes. If I am not mistaken you said that you would take 30 grains of boracic acid three times a day?—I would be quite prepared to take it; I should have no hesitation about it.

2825. Thirty grains three times a day?—Yes, without the slightest hesitation.

2826. You are quite convinced that the presence of boracic acid in milk is not injurious to very young children?—Quite. It is very much less injurious than allowing the milk to become putrid, which used to be so frequently the case with the milk given to young children, and then it had a very bad effect. I cannot see that boracic acid in doses sufficient to make it a preservative would do harm. I have gone into it over and over again, and I cannot see where the toxic effect comes in. It does not seem to have any cumulative effect; it passes away by the urine quickly, and in its progress it seems to be a great benefit to the system.

2827. We have had it in evidence that there is a difficulty in mixing it thoroughly in the milk, and that one portion of a gallon may contain an undue proportion of the preservative?—That is a piece of bad management, because a saturated solution of boracic acid is 1 in 30; 30 parts of water take up one part of boracic acid, and if a saturated solution of that is used in milk then of course you can distribute it quite equally all through the milk.

2828. It is very commonly used in a powder, is it not?—But then a solution of 1 in 30 is a saturated solution of boracic acid; thirty drops contain one grain of boracic acid.

2829. It has been described to us that some milk vendors in selling small jars of cream instead of mixing the preservative with the cream dust the top of it with powder, and therefore the upper spoonful of the cream would be heavily dosed, and parts of the rest would be comparatively pure?—Then they will not get a good effect; they are nullifying the good effects, at least they are taking away the beneficial effects, because if the acid is not distributed equally through the cream it cannot possibly act as a preservative; it can only act upon the parts it is in contact with.

2830. Surely, if cream is preserved by a layer of preserved cream, if the atmosphere cannot get at the rest, it is less likely to be decomposed?—Then it must have been made aseptic beforehand. My impression is that by the way they make cream down at Dunragit, and places in my neighbourhood in Dumfries-shire, they could render the cream quite aseptic without the use of preservatives.

2831. It has been suggested that the vendors of provisions should be obliged to notify the presence of a preservative; would you approve of that being done?—No.

2832. Would you object to it?—I would object to it, because I think it is quite unnecessary information, seeing that the thing is perfectly harmless. People get prejudiced against a thing which is for their own good if they have an idea that there is a foreign body present; they would magnify any danger that exists; in fact, they would make dangers.

2833. You would not call a difference of opinion prejudice, would you?—No. I say if they were men who understood the nature of boracic acid, who were told there was boracic acid present in certain proportions, it would be quite advisable to tell them, at least it would not be objectionable to tell them; but when you have got an ignorant public to deal with it might make them become dissatisfied in a way which is quite unnecessary.

2834. I do not want you to misunderstand my question. We have had several members of your profession in that box, who have given it as their deliberate opinion, supported by evidence from experiments conducted by them, that boracic acid in certain quantities is fraught with danger to the consumer?—I would like to know what the symptoms of danger are, because I have never been able to trace them? I have never been able to see them.

2835. But you admit the existence of that opinion?—I quite admit that.

2836. And being satisfied of the existence of that opinion, you would not call it prejudice?—I think it is prejudice, I do really, because I have experimented very extensively on the subject, and I could never see where the danger of taking boracic acid as a preservative came in. I could never trace any bad effect from it; my results have been all good effects. If it had not been for boracic acid we would have been in a very much worse position as a community to-day than we are at present; I am quite sure of it.

2837. (*Professor Thorpe.*) In answer to a question from the Chairman you said that from your large experience of what went on at Dunragit and in certain parts of Dumfries-shire, which you yourself were personally acquainted with, it was not necessary to add any preservatives to cream?—I mean where it is brought up to a certain point of heat as it usually is, that is, to a greater heat than the germs of decomposition can exist in; if it is hermetically sealed immediately upon that, it is bound to remain sweet.

2838. Cream is a substance which is very liable to undergo change, is it not?—Very.

2839. Is there any more reason why milk should be treated with this preservative than cream?—It would be very difficult to apply that method to milk. Cream is sold in small jars, and these jars can be hermetically sealed when the cream is at a certain heat, and of course then it will remain free from contact with the germs of decomposition until it is sold. But it is hardly possible where milk is sold by the pint and by the quart, or by the half pint, and so on, to hermetically seal that, and milk, I may say, takes on decomposition very quickly after it had been pasteurised.

2840. Even after it is sterilised or pasteurised?—Yes, after it has been pasteurised it does take on decomposition, but not quite as quickly as if it had not been pasteurised. Of course pasteurisation arrests it; it destroys any germs of decomposition which may be present, and it does enable the milk to keep a little longer if it is immediately subjected to a refrigerating process, but, notwithstanding that it still retains its old liability to decomposition.

2841. Do you mean to say there would be no gain to the consumer from the process?—There is a gain in this. I think you gain a few hours, at any rate, by pasteurisation, and you destroy any noxious germs like typhoid or diphtheritic germs, and you only have the germs of decomposition admitted again—that is, germs which produce lactic fermentation.

2842. That gain of a few hours is everything in the case of a milk supply, is it not?—It is very important, indeed, but it has a much more important feature than the gain of a few hours in preventing decomposition, because it destroys all microbes of disease. I think that is where the great advantage comes in.

2843. That is a distinct and positive gain?—That is a positive gain.

2844. And there is also the further gain of a few hours?—There is a few hours' gain, there is no doubt.

2845. The few hours is everything —Yes, but still it is not always practicable; in very hot weather it is even necessary to add a little preservative, I think, because decomposition takes place so quickly.

2846. (*Chairman.*) Are you aware that practically the whole milk supply of Copenhagen is carried in hermetically sealed bottles?—No, I did not know that. I think it is a very good thing to do.

2847. (*Professor Thorpe.*) You recommend that, if possible, at all events, milk should be generally sterilised?—Certainly, I would sterilise milk.

2848. You would recommend that?—I would recommend that as an adjunct, as a first process, in the preservation of milk. I would say it should all be sterilised before it comes into human consumption, but at the same time I would recommend the subsequent addition of a little boracic acid to make things doubly sure.

ELEVENTH DAY

Wednesday, 20th December, 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart. M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. ROBERT MCCRACKEN, called; and Examined.

Mr. R. McCracken.
20 Dec. 1899.

2849. (*Chairman.*) You are the managing director of the United Creameries, Limited, Dunragit?—Yes.

2850. How long has that business been going on?—Between seventeen and eighteen years.

2851. I understand you have been familiar with it since its start?—Yes, I have managed it from the start.

2852. We should like to hear from you as far as you feel at liberty to tell us (we do not want to ask you any trade secrets), first, as to the extent to which preservatives are used; secondly, your opinion as to the necessity of using preservatives; and, thirdly, as to the probable effect on the trade of any restriction. Has your company been in the habit of using preservatives?—Yes, all along—perhaps not in the first years or so, but ever after that we have used preservatives.

2853. In what substances?—In milk, in margarine, and in cream.

2854. And in butter?—No, not in butter; we have never used preservatives in butter. Our butter all goes out fresh without anything in it at all—not even salt.

2855. I do not see quite its use in margarine if it is not necessary in butter?—Fresh butter is not expected to keep any length of time; it is consumed quickly.

2856. What are the principal substances used as preservatives?—We always use boracic acid, or preparations of boracic acid, that is some of those made up preservatives that depend upon boracic acid for their preserving powers.

2857. Is it in your opinion necessary?—Yes. It is in margarine, because we use less salt, as we find that people like less salt nowadays than they used to do; the popular taste favours very slight salting.

2858. Is the natural keeping quality of margarine inferior to that of butter?—No, I do not know that it is; all butter put up for keeping purposes has some preservative in it.

2859. Danish butter is free from preservatives?—It is a little salt, of course.

2860. It contains about 1 per cent. of salt, I think?—It is a small percentage, I really do not know what it is.

2861. But it passes in this country as fresh butter?—In England it is generally called fresh butter; in Scotland we call butter "fresh" when it is absolutely free from salt and anything else.

2862. Could you describe the process of mixing the preservative with milk, for instance?—We dissolve the preservative in a small quantity of milk, and then use that by adding it to the rest; we take a pint or so of it, and add that to a canful of milk.

2863. In your opinion is that thoroughly mixed through the fluid?—Yes, we mix it thoroughly through; we stir it up through.

2864. Is the process the same in cream?—Yes, the process is just the same. We dissolve the preservative in a little milk, and add that to the cream, stirring it well into it.

2865. In what form do you send the cream out?—We send a good deal of it out in jars, and some of it in bulk.

2866. In what quantities?—In cans containing from a single gallon up to sixteen gallons.

2867. Is that all treated in the same way?—Yes.

2868. I may tell you that we have had it in evidence that it is the practice of some vendors after the cream is put into the jar to throw dry borax on the top, which, of course, does not get perfectly mixed through it, but that is not your practice?—No; it is all stirred well into it, and thoroughly mixed.

2869. What would be the effect on the milk trade of the restriction or prohibition of the use of these preservatives?—If they were prohibited cream could not be sent to a distance and sold as it is now; it would not keep for any great length of time without some preservative. The same applies to milk in hot weather—in summer weather. It could be vended in the immediate neighbourhood where it is produced, but not carried to a great distance and sold.

2870. Are you not aware that a large proportion of the milk supply of London, for example, is free from preservatives?—I have no doubt there is a large proportion of it, but still there is a good deal of it with preservatives, and what is sent in without preservatives is consumed very quickly—it will not keep a length of time. Of course, if it is very well cooled, if it is thoroughly refrigerated that will help it to keep, but the effect of refrigeration will pass off in warm weather before very long; the milk will get heated up again, and be as liable to decompose as before.

2871. May I ask whether your opinion is the result of experience?—Yes, it is.

2872. These preservatives are of comparatively modern use; how was the milk trade conducted before they were introduced?—Milk was not carried a great distance long ago; all the towns got supplied with milk produced either in the town or immediately round about it. Now the dairies are being eliminated from the towns, and milk is carried a great distance. We send milk up to London from Scotland.

2873. That is a question of how many hours?—The milk that we get in the morning will be in London the next morning.

2874. That is a question, then, of twenty-four hours?—Yes, but then it requires to be kept until it can be consumed.

2875. Can you give us an idea of the extent of your creameries—how many cows may we take it supply you?—I cannot very well say the number of cows, but in the summer time we get from 10,000 to 12,000 or 14,000 gallons a day of milk—that would be about 4,000 or 5,000 cows.

2876. Does the farmer in any case treat the milk with preservatives before it comes to you?—No, we get it free from preservatives of any kind.

2877. (*Professor Thorpe.*) May I ask if you stipulate that it shall be free?—Yes.

2878. (*Chairman.*) Have you a fixed proportion, irrespective of season, of preservatives added to milk?—We only use preservative in milk in warm weather—in summer; we do not use it in the winter time, when the weather is cold. We use from half-an-ounce to an ounce to a sixteen-gallon can, which is the size of our cans.

2879. (*Dr. Tunnicliffe.*) An ounce would be about 30 grains to the gallon?—Yes, we never exceed the ounce.

2880. (*Chairman.*) Have you ever had any complaints?—No, we have never had any complaint of any kind re-single gallon up to sixteen gallons.

2881. Have proceedings never been taken against you for it?—No, never.

2882. (*Professor Thorpe.*) Why do you find it necessary

Mr. R. McCracken.

20 Dec. 1899.

to add preservatives to a substance like margarine?—It enables it to keep longer—just as we add salt to it for that purpose.

2883. You do add salt as well as preservatives?—Yes; I do not know that absolutely fresh margarine is consumed anywhere. I have not heard of it.

2884. Considering that the greater proportion of margarine (even that which is imported into this country) does not contain boracic acid in any form—either borax or boracic acid preservatives—I do not see the necessity of adding it in your case?—We find that it does keep better with it; it keeps longer.

2885. What conduces to the change in the margarine—what is it that goes off, or that affects its character?—The milk that is in it.

2886. The milk that is in it?—Yes, there is nothing in the fats to go wrong of themselves, it is simply the milk.

2887. Then some change in the manufacture of the margarine would eliminate that?—I do not know.

2888. You add milk to the margarine, for what purpose?—To flavour it.

2889. But you could get that flavour, I suppose, in some other way, could you not?—I would be very glad if you could find me another way to get the flavour of milk without adding it.

2890. Is there not a great deal of margarine that is made that does not contain added milk?—I do not know that there is.

2891. Have you seen margarine made in Holland?—No, I have not seen it made in Holland.

2892. Will you take it from me that there is a very large quantity of margarine made in Holland in which there is no milk whatever?—Yes, I will take it from you that that is the case.

2893. And also that it has no preservative in it?—That may be.

2894. Have you tried sterilising your milk at Dunragit?—No, we do not sterilise any milk.

2895. Have you not made any attempt to sterilise?—We have experimented with it, but I do not like sterilised milk at all; I do not like the flavour of it, and I do not think it will ever become popular. We have scalded a great deal of our milk; that is, we have pasteurised a great deal of our milk. We do not sterilise the milk.

2896. Pasteurising is one form of sterilising, is it not?—Yes.

2897. (*Chairman.*) I was going to ask when you talk of the flavour of sterilised milk, what process of sterilisation you refer to?—The ordinary process of raising the temperature; that is, putting it in bottles and scalding it, and cooling it again twice or three times over. Is that pasteurising?

2898. (*Professor Thorpe.*) That is one method of pasteurisation; have you tried that?—Yes.

2899. Any more than experimentally?—Not more than experimentally.

2900. (*Chairman.*) Do you find it impart a flavour to the milk?—Yes, it does. In sterilised milk that I have bought and tasted I have found the same flavour; it has always a cooked flavour.

2901. (*Professor Thorpe.*) It may have a flavour, but I do not know that the flavour is necessarily objectionable?—I think it very objectionable, and most milk consumers, I think, do so too.

2902. To what temperature do you raise the milk to pasteurise it?—We raise it to about 160 or 170 degrees Fahrenheit.

2903. Your experience perhaps has not been sufficient to enable you to give to the Committee any idea what increased cost there would be in sterilising the milk and pasteurising it?—No; I know nothing of the cost of sterilising at all. It is mostly skim-milk that we send out (we do not send out much new milk), and we pasteurise the whole of it.

2904. You do not send out much new milk?—No.

2905. Only skim-milk?—Yes.

2906. Skim-milk, I suppose, is less liable to change than even new milk, is it not?—I do not think it is; I think it changes quite as quickly.

2907. I suppose, as a matter of fact, you probably find that the price you get for the skim-milk would not enable you to sterilise it?—No, I do not suppose it would.

2908. Is that a reason why you have not done so?—No, that is not the reason at all. We have never attempted it.

2909. Where does your skim-milk go, may I ask?—It goes all into the cities.

2910. To be sold as separated milk?—Yes, during winter; in summer we do not sell much of it; we make it into cheese in summer.

2911. May I ask if a large quantity of that skim-milk comes to London?—No, not much; some of it goes to London. The carriage to London spoils it, we cannot afford the carriage to London.

2912. You mean it is spoiled because you cannot afford the cost of the carriage of skim-milk to London?—That is so.

2913. (*Dr. Bulstrode.*) With regard to the pasteurisation of milk, do you know anything of the Havant Dairy Factory—have you heard of it?—No.

2914. It is a company which apparently carries on its trade entirely in pasteurised milk?—I do not know of it.

2915. You do not know whether they have come to grief owing to their milk (according to you) not tasting well?—No.

2916. You have no knowledge of it?—I do not know anything of them at all.

2917. You never heard of them; you have not had one of these pamphlets sent to you (*producing a pamphlet from the company*)?—No.

2918. Do you know anything about the conditions of the milk supply abroad?—No, I cannot speak as to them.

2919. In Belgium, for instance?—No, I know nothing of them.

2920. Do you think it is likely that there are any different conditions obtaining in a place like Brussels to those obtaining in Edinburgh or Glasgow?—It is quite likely.

2921. Do you know that in Brussels they use no preservatives at all in their milk?—I am not aware of it, but it may be so.

2922. Do you know that the Aylesbury Dairy Company carries on its trade without the use of preservatives at all?—No, I am not aware of that.

2923. If you were satisfied that the Aylesbury Dairy Company did carry on its trade and supply a considerable proportion of the population of London with milk which is not treated with preservatives, would that alter your view as to the necessity of preservatives?—The Aylesbury Dairy Company may be able to get milk which is all thoroughly refrigerated at the farms. They, perhaps, stipulate that the farmers must supply them with milk refrigerated immediately it is milked, and, of course, that will assist the keeping.

2924. Do you think that even if all milk were refrigerated at the farm there would be no use and no need for preservatives?—There would be much less need certainly, because if you chill the milk down at once it will certainly keep much longer; but there are many farms where that cannot be done, as they have not got a water supply.

2925. You say that the farmers in the cases in which you are concerned do not add the boracic acid to the milk before sending it out?—No; they do not.

2926. Do you test the milk?—We do not test it for boracic acid, but we stipulate that there is nothing to be added to the milk.

2927. But you do not check them by analyses?—No, we do not.

2928. You state in your synopsis that you think the use of preservatives should be restricted to a reasonable proportion; would you tell the Committee what you consider to be that reasonable proportion?—I think something like the proportion I have been using is reasonable—not to exceed about 30 grains to the gallon or so.

2929. (*Chairman.*) And in margarine?—In margarine about one-half per cent.

2930. (*Dr. Bulstrode.*) You think there would be no objection to that?—I think not.

2931. But you think it ought to be restricted?—I think so. There is no doubt that there are some places where each dealer adds a little more to it, and so you get an excessive quantity in the end; when the milk passes through two or three hands each dealer may add a little to it.

Mr. R. McCracken.

29 Dec. 1899.

2932. Do you know anything about the use of formaldehyde in milk?—No; I think I tried it in a few samples once, but that is all.

2933. (*Dr. Tunnicliffe.*) Do you send out each lot of milk as you get it?—No, we do not. We receive the milk, weigh it, then it runs into a large vat, and then we send it out from that.

2934. How often do you send out milk?—Daily.

2935. Daily?—Yes, several times daily by different trains.

2936. Then no fraction of milk stays in your creamery more than twenty-four hours, for instance?—No. We do occasionally have a little at this time of the year left over on a Monday to the Tuesday; and we keep that—perhaps it will be in the place fully twenty-four hours; it is brought in in the morning, and it will get away by ten o'clock, say, the next day. That will be twenty-four or twenty-eight hours at the outside.

2937. Then it may be taken that within twenty-four hours of arriving it is mixed and sent off?—Yes. We add the preservative to each can as it is prepared for going out; so that it is pretty accurately done.

2938-39. (*Chairman.*) We have had it in evidence that the Irish fresh butter would be practically ruined if the use of preservatives were restricted or prohibited; is there anything in the quality of Scottish butter which renders it easier to keep than Irish butter?—No, but our butter is put much more quickly on the market than the Irish butter is. The butter that we make to-day is on the market to-morrow morning. I find that some of the Irish fresh butter does not keep very well. We sometimes have to fall back on Irish fresh butter at this season of the year; and there is some of it that does not keep very well.

2940. You are purchasers of Irish butter then?—Occasionally just when we run short, we get a very short supply of milk in the winter for two months.

2941. Then, of course, your demand on the Irish producer is an intermittent and irregular one?—Yes, it is very irregular.

2942. But if the Irish creameries and factories were supplying a market regularly, the difference in time would not be so very great, would it?—Yes. From the West of Ireland it takes butter a little while to get into the market; we do not get it until three days after it is made.

2943. No, but I have already pointed out that your demand is a very irregular one?—Yes, it is.

2944. Suppose a factory in Limerick were supplying a merchant in London, the element of time would not be a very serious one, would it?—No; it would be an extra day, I suppose, or so.

2945. Only an extra day?—Yes, that would be about all.

2946. Then in your opinion it is nothing in the quality of the butter that renders it necessary to add borax to the Irish butter?—It will depend on the making, of course. If very carefully made you can do without it, if your butter is going to be consumed very quickly.

2947. I am speaking of factory and creamery butter?—There is a great variety in factory and creamery butter.

2948. (*Professor Thorpe.*) Is the variety due to the mode of manufacture or to the quality?—It is due to the mode of manufacture, and, of course, to the handling of the milk before the manufacturer gets it. In some of these small places in Ireland they cannot keep their milk very well; but if they are getting it twice a day in the factory, they should be able to make as good an article in the West of Ireland as anywhere.

2949. (*Chairman.*) After your long experience in this business we should like to have your opinion whether there is anything in the quality of pasture which renders one butter a better keeping article than another?—I do not think there can be, at all.

2950. It depends on the manufacture?—Yes, of course that is supposing that the cows are getting good water, and all that sort of thing; if there is anything defective that way it will affect the butter.

2951. Would you find that 1 per cent. of salt would interfere with the popularity of your butter?—Decidedly it would; we require to have it absolutely fresh.

2952. Have you any experience of Danish butter?—Yes.

2953. Does any of that come absolutely fresh to this country? Is it not the case that a great deal of Danish butter is sold in this country as fresh butter, which does contain 1 per cent. of salt?—I believe so; but then that is not competing with butter which is absolutely fresh. A great many people like just a very little salt in butter; we are often asked by private individuals to make up butter for them with a little salt in it, but our trade is in absolutely fresh butter as a rule.

2954. Now, to turn to the other branch of our inquiry, namely, colouring matters; I suppose the use of those in dairy products is pretty general?—Very general; it is universal I think.

2955. But there is not a great variety of substances used?—No, not a great variety.

2956. The chief substance being what, should you say?—Annatto.

2957. May we take it that in the Scottish dairy trade that is the only substance used?—Perhaps not the only one, but almost the only one.

2958. Almost?—Yes, aniline colours are used no doubt.

2959. But in your creamery is annatto the only one used?—It is not the only one; we have used aniline colours. It is generally annatto that we use.

2960. Your object is, I presume, to obtain a uniformity of colour—summer and winter, in butter and cheese?—Yes.

2961. Would it interfere with your market if you discontinued the use of colouring matters?—Yes, it would cut us out of some markets altogether; some markets will not take white cheese at all.

2962. Others, on the other hand, will not take coloured cheese?—That is so.

2963. What is the object of colouring margarine?—To make it pleasing to the eye, just the same as with the cheese, and to suit the market. Some markets take pale-coloured margarine, and some take the higher coloured margarine.

2964. In your opinion does that arise from the preference of some districts for pale butter, and of others for dark butter?—I expect it does.

2965. Therefore the object of colouring margarine is to resemble butter?—Yes, it is coloured to resemble butter—there is no doubt of that.

2966. Would you see any objection or hindrance to trade if the obligation were imposed on the manufacturer of declaring that certain articles were coloured?—I do not suppose it would make any difference; butter is coloured all over the country now to suit.

2967. I am not quite sure that you understand me, or if I have put my question in an intelligible form. Suppose it were made obligatory on the manufacturer or vendor to sell articles with a declaration that they are artificially coloured, would that interfere with the trade?—No, I do not suppose it would, except so far as it would be harassing the salesman by having another declaration to make. It is not only dairy products, but a great many food products that are coloured. Would you suggest a declaration as to colouring in every one of them?

2968. I did not ask you about other products, because you are not an expert in them?—No, but I think all should be kept on one level. I do not see why one industry should be singled out for declarations, and another that also uses colouring matters, let alone.

2969. Suppose it were made obligatory upon manufacturers who colour green peas with copper to declare that they were so coloured, would you think it a hardship on the cheese-maker to have to declare that his cheese was artificially coloured?—No, I do not suppose it would make any difference to him really. I think almost everybody knows that cheeses are coloured.

2970. (*Dr. Bulstrode.*) I understand you would have no objection to the nature of the colouring matter being stated on the label, for instance: "This butter is coloured with annatto"?—No; if you are going to make a declaration at all you may just as well state the nature of the colour.

2971. You think there would be no objection to a declaration of that nature throughout all coloured trade products?—No, if you make everyone give a declaration, if you make every trade do it; but I do not see why one trade should be picked out and another let alone.

2972. You see no objection if all trades were similarly treated?—Not if they were all put on one footing, but I see a great objection to it if one trade is singled out, and another let alone.

Mr. R. McCracken.

20 Dec. 1899.

2973. If it were put on sweets, say: "These sweets are coloured with ——", well a poisonous colour, do you think people would buy them?—No; I think it is quite likely not.

2974. You think it might be an objection in that sense? —It would be objectionable to the manufacturer in that sense, but if it were poisonous I think everyone should know.

2975. Do you think if coloured peas were labelled: "These peas are coloured with copper," that would make any difference to the seller?—I should think it would; I think people would avoid them.

2976. (*Dr. Tunnicliffe.*) What aniline colours do you use in the manufacture of butter or margarine?—I really do not know what the actual article is.

2977. You do not know what they are called?—No; I find that there has been aniline colouring in one of the butter colours which we have used.

2978. I suppose they would be yellows?—Yes; but the quantity is so small that it would practically do no harm.

2979. Where do you get these aniline colouring matters from?—They are mostly from Continental manufacturers.

2980. You do not know the chemical names of them, or the trade names of them?—No.

2981. Nor anything about them?—No; we buy it as butter colouring..

2981*. You buy it as butter colouring, do you say?—Yes; and we get a solution in oil just as we get annatto colouring.

2982. Only you know the difference that one is annatto and one is an aniline colour?—We have been told so.

2983. Is it on the bottle?—No, but the manufacturer informs us that there is a proportion of aniline colour along with annatto in it.

2984. Is there a declaration on the bottles of all these different colouring matters, as to what they consist of?—No.

2985. How do you know the difference between them? —The manufacturer has told us that he does use a little aniline colouring in making up the colour.

2986. Then does every annatto that you use contain a little aniline colouring?—No, I do not think so at all.

2987. Do you know that it does not?—No, I do not know that it does not; I have never submitted them to analysis at all.

2988. Do you get an annatto colouring matter from the same place that you get the aniline colouring matter from?—No.

2989. In short you do not really know what the annatto colouring really contains—No, we buy it for annatto, and that is all we know about it. We expect that we are dealing with honest people, and that they give us what we ask for.

2990. (*Chairman.*) If you use annatto, and it contains some other substance, that would come under the Food and Drugs Act as an adulteration, would it not?—I suppose so.

2991. How long does margarine treated with borax keep?—A good deal would depend on the margarine, and on the weather. Margarine would keep for a month or six weeks.

2992. How long should it keep as compared with fresh butter?—It will keep far longer than fresh butter.

2993. Would it keep four times as long?—It will just compare with salt butter—with cured butter.

2994. We have heard a good deal about the relative percentage of water in Irish butter compared with Danish butter; can you give us the percentage in a good sample of Scotch butter?—I have had analyses taken but I do not recollect exactly just now what the result was. I could not say positively.

2995. Would you say generally that Scotch creamery butter is wetter or drier than Irish butter?—It is much dryer than Irish butter.

2996. Would you say that it approaches to Danish butter in consistence?—I think it is fully as dry as Danish butter.

2997. (*Professor Thorpe.*) May I ask whether you at Dunragit make what are known in the trade as mixtures? —Yes, we make mixtures.

2998. As regards the aniline dyes I suppose they are German produce, are they not?—German or Dutch. I think this is Dutch that we are using.

2999. They are vended to you by Dutch makers?—Yes, by a Dutch maker.

3000. You have no knowledge of what their nature is? —No.

3001. You are not aware, for example, that they really are most noxious substances?—They may be.

3002. There is no doubt about it these substances dissolved in oil are really at the base very noxious substances. You have never heard of a compound known as Martius' Yellow, which is used as a butter colouring? —No.

3003. You do not even know that is the same substance which is put into a lyddite shell?—I know that lyddite has been used for dyeing purposes for a century.

3004. Give us your opinion about the declaration in the case of colouring matters; would your statement about preservatives equally apply in regard to colouring matters, that is, would you see no objection to persons declaring that the substance contained colouring matters? —I do not think there would be any great objection to it except that it is just troublesome to the vendor, and apt to get him into trouble through neglecting to declare it. It is a very harassing thing to trade if a man has to make a declaration with every article he hands over the counter.

3005. If it were proved to you, for example, that in the case of the milk supply for very young children the presence of these preservatives was very hurtful to them in the early stages of their existence, would you not see some necessity for a declaration of their presence?—Yes, if there is such a quantity of preservatives used as to be injurious.

3006. If it is proved to you even that the small quantities which are actually used in trade have that effect, I suppose you would agree that it is desirable in the interests of the community that something in the nature of a declaration should be made?—Yes; if that is actually proved, but there seems to be a great difference of opinion on that point.

3007. (*Chairman.*) Is it pure borax or a compound that you use?—It is generally borax; we do use compounds.

3008. (*Professor Thorpe.*) You use so-called preservatives, do you not?—Yes, we do, and we use the boracic acid; but we use more boracic acid than preservatives.

3009. Then you use more boracic acid than borax?—Yes, that may be.

Mr. C. J. Dunn.

Mr. Christopher J. Dunn, called; and Examined.

3010. (*Chairman.*) You are the Chairman of the Cork Butter Market Trustees, are you not?—Yes.

3011. And a governor of the Munster Dairy and Agricultural Institute?—Yes.

3012. You represent the Cork Butter Market Trustees before this Committee?—Yes, I do.

3013. We have already had some evidence about the use of preservatives in butter and milk in Ireland. Can you tell us anything from your experience about them?—The buttermakers who send butter to the Cork market, as a rule, do not put a preservative in their butter, but a preservative is very largely used in butter factories. It is also used in creameries. A considerable quantity of the butter passing through our market comes in in the lump state—in the half-made state; that afterwards goes into the factories, and probably a preservative is put in that. The preservative generally used is some soluble borate of soda, something like a tetra-borate of soda. The advantage of using it is supposed to be that it is more soluble than the boracic acid itself, boracic acid being soluble only to the extent of four per cent., and the other being very much more soluble consequently gets more easily blended and mixed up with the butter.

3014. You say that a great deal of the butter that comes into the Cork market is free from preservatives?—Yes. The butter bearing the brand of the Cork market is butter which has been in most cases made up by the farmers

Mr. C. J. Dunn

20 Dec. 1899.

themselves, and the farmers, as a rule, do not use it, although some years ago the trustees of the market recommended its use to the extent of 1lb. in 112lbs. The circumstance that forced their hand to make that recommendation was that they found that it was being largely used by their foreign competitors, and also that it was being largely used by home traders, who did not send their butter through the market, and they thought, therefore, that it would give an advantage to the farmers who were sending their butter through the market if they were to use a preservative, because it would make their butter keep longer than it had kept previously. But in spite of that recommendation the farmers generally throughout Munster did not take up the use of a preservative, and at the present day it is only a very small percentage of the butter bearing the brand of the Cork market that has a preservative in it.

3015. Do I understand that much of the butter which comes into the market afterwards goes into the factory?—Yes. There is a new department established in the market in the last two or three years, and in that department half-made butter comes in in the lump state fresh from the churn, without any preservative in it, or with the butter-milk scarcely thoroughly washed out of it. That, then, is bought by owners of butter factories, and they blend it and mix it up and put salt into it, generally speaking; generally speaking, also, they put preservatives into it. Then they pack it in their own packages and send it across. This is the factory system. You know, there are three systems of making butter adopted in Ireland. There is the creamery system, the factory system which I have mentioned to you, and the old-fashioned dairy system, where the farmer makes the butter himself and sends it to our market or sends it somewhere else, and the farmer, as a rule, does not put in a preservative himself.

3016. You spoke of your foreign competitors. What countries would you name as the principal competitors with Irish butter?—All countries; that is to say, it would be very difficult to say which of them competes more directly with the Irish butter; but all of them compete more or less directly—Danish butter, French butter, Canadian butter, and Australian butter. Australian butter very largely takes the place of the Irish butter, which in the old days used to be heavily salted and meant to keep through the winter. Now the Australian butter coming in from the Southern Hemisphere comes in at a period when it is intended to take the place of that butter; and that is one of the causes of the decline in the heavy salted Irish butter—it has to keep so long.

3017. Take the country which you named first just now, Denmark; Danish butter is without preservatives, is it not?—Yes; I understand that they very largely pasteurise the milk, and in that way the butter keeps. One of the creameries in Cork I know from my own knowledge pasteurises the milk, and, I believe, does not use a preservative. But you see, it would be impossible for the butter factory system to protect itself by pasteurisation, because they buy the butter from the farmers as it comes in, and the farmers do not pasteurise.

3018. Is it not the case that in Denmark a great deal of the butter is factory butter?—I am not aware. I suppose it is—I am sure it must be. Though a very serious inconvenience would be caused by the prohibition of preservatives, I am inclined to think that the wholesale butter merchants rather exaggerate it, and that it would not be as permanent as they imagine—that is, that the retailers to whom they sell would soon find out that every one was in the same position, and they would see that butter could not be expected to keep as long without a preservative as it did with it, unless it were pasteurised at least, and even then possibly not quite so long. I give the trade generally credit for sufficient inventive power to discover some other method for keeping the butter—cold storage might be developed to a very great extent.

3019. Would there be a strong objection on the part of the trade to making a declaration necessary as to the difference between fresh butter and preserved fresh butter?—There would be a strong objection to their having to make a declaration—that is, to give a warranty that it was not preserved, if you mean that.

3020. No. I mean to make a statement that it was preserved?—I do not think so. I do not think they would have any reasonable objection to make that statement. I myself may mention that I am not in the trade.

3021. But you represent the Market Trustees?—Yes, and I have had very exceptional opportunities of knowing all about the trade through my position as chairman of the Butter Market. The members of the Cork Butter Market Trustees differ among themselves very much on the subject as to whether the prohibition of the use of boracic acid or other preservative would in the long run be an injury to the Irish butter trade, or an advantage to the Irish butter trade. Some of them who have butter factories themselves see how very seriously it would inconvenience themselves, at first at least. Others who deal directly with the farmers, and who deal only in farmers' butters, think that it would be a great advantage to the home producers in competition with their Australian and Canadian rivals if preservatives were prohibited all round.

3022. Do you mean that the public would perhaps show a preference for unpreserved butter, for absolutely fresh butter?—I mean that if the Government were to interfere and make the use of preservatives illegal, as has been done in other countries, some members of the Butter Market Trustees think that it would benefit the Irish butter trade rather than injure them; but others, on the other hand who are owners of butter factories appear to dread such a prohibition very much.

3023. Do you know any quality in the Irish butter which renders the use of preservatives more necessary than in Scotch or English butter?—No, certainly not. I do not believe there is any quality in the Irish butter which makes preservatives more necessary. Why, the history of Irish butter is that it was the butter thirty years ago that was made specially for keeping, and that did keep before a preservative was used or known of.

3024. We have had witnesses from Ireland who have expressed the opinion that Irish butter could not be made as dry as Danish butter, and that therefore it never could have the same keeping property; is that your opinion?—No. It is not made as dry as Danish butter, I believe, as a matter of fact—certainly not at all as dry as Australian butter; but Irish butter has had for a very long time a great reputation as a keeping butter, and I believe it could keep as well as any butter in the world. I have brought with me a pamphlet on some experiments that were tried about the use of water in butter some years ago, if you would wish to look over it. They were made at the Munster Agricultural Institute. There are a number of tables in that pamphlet. I think it is the most thorough investigation that was ever made into the subject of water in butter.

3025-26. Can you tell us any general conclusions founded on these experiments?—The experiments were undertaken for the purpose of seeing whether it was desirable to use warm pickle in order to make the butter keep better; and it was found that the butter that was salted on the system of using the dry salt kept just as well. It was then argued by some people that it was necessary to put in hot, warm pickle in order to make butter keep, and the effect of washing it with warm pickle and mixing it up with the butter was that a considerable amount of this pickle used to become incorporated with the fat of the butter, and it was held at that time that that was the best way, or one of the best ways, of making a butter keep for a long time. But the investigations and the experiments went to show that that was not the case, and that it would keep just as well if salted without so much water being incorporated with the butter.

3027. Of course, with fresh butter those experiments would have no bearing?—With regard to the keeping qualities, no.

3028. There is no particle of salt in fresh butter?—No, there is no salt in fresh butter.

3029. Then its keeping quality would depend principally on the extent to which the butter milk and the water were expelled from it?—Chiefly; the washing out of the casein, as chemists say. It has often been said that butter coming from some districts keeps better than butter coming from other districts, and that has been attributed to the pasturage in the districts. Butter coming from mountainous districts is supposed to keep better than butter coming from low-lying districts, but that question has not been really investigated thoroughly and scientifically. It is a common belief amongst the trade, however.

3030. Is the use of colouring matter habitual among Irish butter-makers?—No, it is rather going out; the fashion for highly-coloured butter has disappeared to some extent latterly. The colours used were saffron and annatto. I never heard of an aniline colouring being used.

3031. Do manufacturers as a rule not endeavour to obtain uniformity of colour summer and winter?—As a rule they do aim at it a little, and then they put in a

Mr. C. J. Dunn.

20 Dec. 1899

little saffron in the winter, or a little annatto; but the taste for highly-coloured butter in the trade seems to have declined as far as we can judge in Ireland.

3032. (*Professor Thorpe.*) In your opinion, is there any connection between the amount of water which is in the butter and its keeping character?—I do not think there is.

3033. Do you not think that the keeping character of Danish butter which contains no preservatives and very little salt is in some way connected with the relatively small quantity of water which it contains?—I do not think so. I am more inclined to the opinion that it is caused by pasteurising the milk.

3034. The Danish butter has always had the reputation for keeping, has it not—at least, within a moderate length of time?—I am not aware that it had formerly a greater reputation for keeping than any other butter, but it may have been so without my having happened to have heard of the fact.

3035. It is only comparatively recently that they have systematically pasteurised their milk in Denmark, is that not so?—Yes. I think, though, that the Danish butter trade, as a rule, has been for rapid consumption; it has been delivered to the markets very rapidly; they go in for winter dairying there, and the supply is pretty constant throughout the year, and the consumption goes on equally constantly. I do not think the Danish butter has been kept as long as the Irish butter used to be kept formerly, or is kept even still.

3036. You mean when Irish butter was heavily salted?—Yes. When it was heavily salted. Large quantities of it used to be stored in the summer with the intention of not taking it out of the store for five or six months. But the fashion for heavily salted butter has changed.

3037. In regard to this question of the amount of water in Irish butter, no doubt that has come under your notice?—Constantly; it came so much under our notice that the Munster Dairy and Agricultural Institute, to which I belong, made a very exhaustive series of experiments a few years ago, some of the results of which you can see in this pamphlet.

3038. Would you hand that pamphlet in?—Yes, certainly; with pleasure. (*Handing in same.*)

3039. Are you able to say if you came to any conclusion as to what might be considered a normal amount of water in Irish butter?—You have a number of statistics in that little volume on the subject. The normal amount, I suppose, would be about 14 to 15 per cent.

3040. Do you think that there would be any hardship in requiring the trade to conform to a standard of 15 per cent. of water?—There would be no hardship in general, but some individuals would suffer. In the butter market some years ago we found that there was a lot of complaint about water in butter, and we made a rule at that time that no butter containing more than 18 per cent. of water would get the brand of the market, and if butter contained 20 or 21 per cent. we used to prosecute for a long time in almost all cases. The effect of our action was that we very much diminished the quantity of water that was used in butter. We had a system in the market of analysing the butter on the spot. If the butter inspector in going through the butter to award the quality suspected that there was an undue proportion of water in the butter he sent up a sample immediately, and in ten minutes he was told what the percentage of water was in it. If it was more than eighteen per cent. it was not marked—it was rejected, and would not get the brand; if it had more than twenty per cent. it was put aside to see whether the man should be prosecuted or not for having put it in intentionally.

3041. I suppose that action was in a large measure due to the effect of the competition with the Danish butter?—It was immediately due to some prosecutions that had taken place in England, notably a Manchester prosecution, where there was over 20 per cent. of water, I think.

3042. It was not the effect, you think, of the competition of the drier Danish butter with you?—No, I think it was the effect of legal proceedings.

3043. I am asking this because you possibly have seen that in the amended Food and Drugs Acts there is a provision which implicitly will contain a definition as to when butter becomes impoverished, the impoverishment being the undue admixture of water?—And what quantity of water would be considered an illegal amount?

3044. I am not in a position to tell you that, but I should be glad to know what your own opinion is of what it might legitimately contain?—It is a very difficult question. I tell you what our action has been. We will not put the brand of our market on any butter that contains more than 18 per cent., though we do not believe that that butter may necessarily be fraudulent in consequence. Still we will not put our brand on it.

3045. I think you said in evidence that your own opinion is that from 15 to 16 per cent. is a proper amount?—Yes, but that that amount would be exceeded sometimes without any fault on the part of the maker, and it would be rather severe treatment to make him liable to pains and penalties.

3046. Not actually a fault, perhaps, but rather an error of omission?—Culpable negligence.

3047. Rather more care in the manufacture would lower the amount, would it not?—In very hot weather, you know, there is very great difficulty in pressing out the water; in very hot weather you cannot express the water. You will injure the butter; you will damage what traders call the grain of the butter if you overwork it in very hot weather.

3048. That, I am informed, is a manufacturing condition, which can be easily overtaken with care; a skilful dairymaid would never let her butter work into that condition?—If a skilful dairymaid has very cold water—either drawn from a cold natural spring or iced—my opinion is that the water could be naturally got out.

3049. The butter never gets into that extremely oily and broken up condition if skilfully treated, does it—it maintains its grain by skilful treatment, even in hot weather, does it not?—Even in hot weather, if you have cold water. In many cases, no doubt, the hot water was put in for the purpose of increasing weight, but in many other cases it has been produced by accident, by the fact that the maker could not get cold water.

3050. (*Dr. Tunnicliffe.*) Do you think the price of butter would be materially altered by the restriction or prohibition of the use of preservatives?—I do not. I think that the development in cold storage would very largely compensate for the prohibition of preservatives, and I think that the supply is more constant all the year round now than it used to be. You have the Australian and New Zealand supply, which comes in at a time when the home supplies run short, and I think that would largely compensate for it. Undoubtedly the price would be at first altered a little.

3051. Do you know how the preservative is added to the butter?—It is very frequently mixed with the salt. Some years ago a friend of mine who had a butter factory told me that he would mix a quantity of pure boracic acid, say 1lb., with a certain quantity of salt, and then he would have this 1lb. of boracic acid mixed up with 100lbs. of butter; that was the proportion. It is now more general to use the soluble borates of soda.

3052. It is not added now in the form of pickle?—You could not add that quantity in the form of pickle because it is soluble to the extent of only 4 per cent.; therefore, you could not put it in in that way; you could not incorporate it.

3053. It was only the warm salt that was put in the warm pickle?—Yes. The amount of preservative that you would get in in that way would be very small—at least, of boracic acid, for of course, you would get more of the preservative because it is more soluble. In some cases the preservative may be added in that way, but I think it is generally mixed with the salt dry and then put in. I know in the one case I spoke of it was done in that way.

3054. (*Dr. Bulstrode.*) What extent of the butter trade is governed by the Cork Butter Market Trustees?—A very considerable extent of the trade of Cork passes through the Cork market; thousands of tons in the year.

3055. May we take it to be a very large industry?—It is a very large industry. At one time the butter passing through the market was worth a million and a-half annually.

3056. Do you think your opinion that the prohibition of preservatives in butter would produce only a temporary inconvenience would be the view of the majority of your colleagues or co-trustees?—My colleagues as trustees differ very much on the subject. Some of them who represent the farmers, and who deal only in farmers' butter, would think it a great advantage if preservatives were prohibited altogether; but others who are factory owners know that it would be a serious inconvenience to them, and they appear to me to exaggerate the extent of that inconvenience and the permanency of it. The Board of

Mr C. J. Dunn.

20 Dec. 1899.

Trustees differ very much on the subject, that is the members of the Board.

3057. What do you think would be the effect upon the Australian and Canadian trades, say, of the prohibition of the use of preservatives?—I think it would be very much more serious than the effect upon the Irish trade, because they have to send a very much longer distance. Of course, they would get over that to a great extent by sending the butter, as they always do, in cold stores—the butter would come in and would be kept below the freezing point the whole time.

3058. If I understand you, the development in cold storage would meet the difficulty in England, supposing preservatives were prohibited. Why should not that also, on your thesis, meet the difficulty with regard to Australian and Canadian butters?—It would undoubtedly to a considerable extent meet it.

3059. In your view there is no serious trade difficulty in the way of the total prohibition of the use of preservatives in butter?—I think myself that the traders exaggerate the difficulty, but it would undoubtedly be a serious difficulty at first; that is, a manufacturer of butter, an owner of a butter factory is in the habit of sending butter to a retailer in England, we will suppose, and if that retailer had found in the past that the butter would keep for two or three weeks, but now found that the butter would not keep for two or three weeks under the same conditions, he would certainly make very serious complaints at first, but after a time he would find it was a general case, and he would have to adopt other methods; he would have to get his butter supplies more frequently, and he would have to adopt various other methods of that kind, such as keeping it in cold stores and so forth. I think in that way the difficulty would be got over.

3060. You are of opinion, as I understand it, that if there are any medical considerations against the use of preservatives they should outweigh the relatively small trade considerations?—I am strongly of opinion that they should outweigh trade considerations, great or small.

3061. Great or small?—Yes, I think the medical aspect is the most important one, if it is found to be really injurious. The amount of boracic acid used in butter does not seem to me to be nearly so serious as the amount used in milk, for instance, because a greater quantity has to be used in milk, we are informed; and, in the next place, milk, unlike butter, may be the sole food of certain people, and those very people are people who depend upon a milk diet only, being either infants or invalids, who are very bad subjects for experiments of this kind.

Mr. THOMAS BOND, called; and Examined.

Mr. T. Bond.

3062. (*Chairman.*) I believe you are the Consulting Surgeon to Westminster Hospital, a Fellow of the Royal College of Surgeons, and Bachelor of Surgery and Medicine in the London University?—I am.

3063. I understand that you have given some attention to the use of boracic acid and its effects on the human consumer?—I have.

3064. Will you kindly state to the Committee your views on the subject?—I have given boracic acid internally for many years in doses of 10 grains, and have given it to hundreds of patients in such doses.

3065. For certain diseases?—I have given it in bladder disease as an antiseptic. I have never found any ill effects constitutionally following its administration for many weeks, sometimes for months.

3066. In measured quantities?—Yes; in measured quantities. I have never prescribed more than 10 grains every four hours, or at least four times a day. My usual dose is 10 grains three times a day.

3067. I suppose you would object, or, at least, you would not think it desirable, that your patients should be taking boracic acid from other sources than from your prescription?—I have never warned them against it, you know; but if they were taking it from some other sources I should like to know it.

3068. Would you go so far as to say that you ought to know it?——No; I do not think I would go as far as that. It depends upon the quantity they are taking.

3069. Does it not seem to you to be attended with some risk that a drug prescribed by yourself should be liable to be taken from other sources in uncertain quantities by your patients?—No, it does not. I will give you an instance. I often prescribe nitrate of potash—very often indeed, quite as often as I do boracic acid; but I never take the precaution to find out whether they are eating ham or things that contain nitrate of potash very often in large quantities.

3070. But, pardon me, the analogy is not perfect, is it?—Why?

3071. Take a very young child, whose diet would be principally milk. Suppose that milk were treated with boracic acid in considerable quantities, and, at the same time, you had occasion to prescribe boracic acid; would there not be some risk?—As a matter of fact, I never have prescribed boracic acid for a child, except in a very small quantity, such as a grain dose for diarrhœa; but I do not think there would be any risk.

3072. Would you tell me why you have not prescribed it for children?—Because children do not have bladder diseases, and I am a surgeon who has a great number of bladder diseases to treat, and I do not treat many children.

3073. Not because it is unsuitable for children?—Certainly not. I have prescribed it, I may tell you—not often, because I do not often treat children for diarrhœa—but I have prescribed it in one-grain doses for young children in diarrhœa.

3074. Then, I may take it, that, while you consider boracic acid a valuable drug, you are not aware of any evil effects that have attended its indiscriminate use?—I have known itching of the skin produced in my own patients by it, but that is when they have had kidney disease, and when it cannot be excreted freely by the kidneys. Of course, a great number of the patients that I treat with boracic acid have kidney disease; chronic bladder disease leads to kidney disease, and great numbers of the patients have kidney disease, and I have had cases—I think I might say half-a-dozen cases would be quite the outside number—where I have had to stop it for itching of the skin and a rash.

3075. On the general question, do you think the public would be justified in insisting that the presence of that drug should be notified on all articles preserved by it?—Yes, I think that would be a proper thing to do; I should be quite ready to support such a view a sthat, at the same time I believe it to be an absolutely innoxious preservative.

3076. (*Dr. Bulstrode.*) What dose limit would you put to the administration of boracic acid?—An adult, of course, you are speaking of?

3077. Rather, we will say, in the first place, a child of five years of age?—You would only give it about one-fifth of the quantity which you would give an adult, therefore, as you give an adult ten grains or forty grains—I have certainly given forty grains—you would give a child of five years old, say, a fifth of that.

3078. The pharmacopœial dose is 5 to 15 grains, I think?—Yes, but I am not speaking of a dose, I am speaking of so much in a day.

3079. The total in a day?—Yes; 40 grains in a day is about the total limit that I have ever given internally; that is, as far as I know. I have ordered it for every four hours on many occasions, and that would mean, you see, if they took it at night a dram in the twenty-four hours; but as a rule patients, when they are ordered medicine every four hours, if they are not very ill, with nurses attending them, only take it four times a day.

3080. What would you say would be the maximum dose for a child of, say, five years of age?—From two to three grains, I should think—for a dose, recollect.

3081. Then you would think it dangerous to give the patient more than that?—No.

3082. What limit would you place as regards danger?—I have never found the danger, therefore I am not able to place a limit. If I have never had a case where it has produced any injury, how can I know what the limit can be? I really cannot tell you what the limit is.

3083. As I understand you, you say you have had some half-a-dozen cases in which you have had to stop it?—I have. Those have been old men with dropsy in their legs and renal disease, and those are the cases where I have stopped it.

3084. May we take it that you would regard kidney disease as a contra-indication for the administration of

Mr. T. Bond.

20 Dec. 1899.

boracic acid?—In large doses, yes; it would produce then, I think, a skin eruption.

3085. Do you examine the urine of cases before you administer boracic acid?—No. I examine to see that it requires the boracic acid—that it is decomposed urine. When I administer boracic acid I do it for the decomposed urine—for urine which is turbid and smelling.

3086. Do you consider it necessary to examine the urine to discover whether or not there may be any affection of the kidneys?—No, I have never done so.

3087. But still you would say, from your own experience——? I should say, from my own experience that if you give boracic acid in large doses, such doses as I have mentioned—that is, ten-grain doses three times a-day—you very likely would get a skin eruption and itching of the skin—the itching is generally more pronounced than any eruption.

3088. Then, if you accept the position, as we have had it stated, that kidney disease is a contra-indication for the administration of large doses of boracic acid, would you not say that that was a reason why the use of boracic acid as a preservative should be controlled?—I quite agree that boracic acid in its quantity should be controlled, but I think that it is absolutely harmless in the doses in which it is used as a preservative.

3089. Will you kindly tell the Committee what is the extent in which it is used?—About 5 grains to the pint, I think, is a safe preservative for milk.

3090. Would you consider, on general principles, that it is desirable that a child of two years of age or of one year of age should take, we will say, on that standard of yours, 15 grains or perhaps 20 grains a-day?—That would be four pints of milk a-day for a child?

3091. Yes?—That would be rather a larger quantity than I should care to give a child.

3092. Then you would think that that is perhaps rather too large?—For a young child, yes. I do not know of any harm that has resulted, recollect, but still I should not give it myself.

3093. You think it might be dangerous?—I think so. I think it might be not advantageous to the child, just as I would not give the child large quantities of salt or nitre.

3094. Then you think that the medical man, in prescribing for a patient, ought to know whether or not a patient is taking something which may modify his treatment of that patient?—Certainly; that is a proposition which I will not dispute in the slightest.

3095. Therefore you would advocate upon these grounds that if preservatives are used the nature and the amount should be stated?—Yes, I think that would be an excellent thing to do.

3096. May we take it from you that you advocate that the nature and the amount of boracic acid in preservatives should be stated?—Yes, I do.

3097. With regard to your own individual experience in reference to the external treatment of surgical cases, you have, I think, had no bad results?—Never, and I think I have had a most extraordinary case. I had a child with a bladder which was absolutely unable to hold the urine; a part of the bladder had sloughed away, and therefore the child was in a most horrible state of health. In the Westminster Hospital we kept this child for six months, or longer than that, really in a boracic bath—in a saturated solution of boracic acid. He used to go to bed at night, but sat in the bath all day. That child is alive and well now.

3098. I take it you would not agree with this statement made by Dr. Wild, who has given evidence before us—this is from a paper published in the *Lancet* of January 7th, 1899. He says:—"The use of boric acid or the borates in surgery and their internal administration, though usually free from danger, ought to be carefully guarded in patients whose kidneys are diseased, and immediately discontinued should dermatitis or other toxic symptoms appear. In suspected cases the examination of the urine for boric acid and borax may afford valuable evidence of the absorption of the drug"?—I agree, to a certain extent, that it is contra-indicated in large doses in kidney disease, for the reason that I have told you—that I have found eruptions.

3099. Would you think that with the indiscriminate use of boracic acid at the present time—and I may tell you as a fact that as much as 26 grains of boracic acid have been found in a pint of milk—there must be a considerable number of people who are taking boric acid in a dose, which I understand from you and from others is distinctly contra-indicated by their condition?—If I answer that question by "Yes," I shall not explain myself properly. I say at once that 26 grains in a pint of milk is a great deal too much—more than is necessary, and more than it is proper to use, and it is not used. I know enough about food preservatives to know that that is a most out-of-the-way case, and if it is stated that that is usually done it is wrong.

3100. What I wish to imply is that at present the conditions are such that there is nothing to prevent it?—No, there is not.

3101. You would agree to that?—I agree that if 26 grains were put into a pint of milk it ought to be known to everybody who takes that milk.

3102. (*Chairman.*) I suppose Mr. Bond understands the liability of milk passing through several hands to receive an additional preservative?—I do know that there is that liability.

3103. (*Dr. Bulstrode.*) Have you read the report of Dr. Annett's experiments on kittens?—Yes. That experiment is not worth anything much, because if you come to dissect it it comes to this—that he has 10 grains of boracic acid in a pint of milk. I suppose about three kittens—newly-born kittens—would go to a pound, and a new-born child is about seven pounds. Therefore the proportionate dose that he has given to those kittens is exceedingly large. Assuming a new-born child takes two pints of milk, the child will take 20 grains a day; assuming the kitten takes half-a-pint of milk, the kitten will take five grains. Now, there being over twenty kittens to a baby in weight and in everything, the proportionate dose would be less than one grain for a kitten; if a child takes 20 grains a kitten ought to take less than one, and, as we know, 20 grains would be a largish dose for a child. Therefore, he is giving a kitten probably five grains a day, for, as far as I am able to judge, I think a kitten would take about half-a-pint of milk in the twenty-four hours.

3104. I only mention that because I wanted to have your opinion on it?—That is my opinion about that—that he has given the kitten a very large dose. I believe that if he gave an equal dose of salt it probably might have just as deleterious an effect—I do not know.

3105. Then, with regard to the question of salicylic acid, would you give the Committee your experience in reference to that?—Yes. That is a drug which I have given in the same doses. The usual dose is 10 grains, and I have given it at times in warm water. It is very difficult to dissolve salicylic acid—you can only dissolve it in warm water unless you have a very large quantity, and then it is rather disagreeable to take. I have also given it mixed in potash in a mixture of 10-grain doses constantly, and there it is quite easy to take, and I have never seen the slightest ill result occur from taking it.

3106. From taking the salicylic acid?—Yes.

3107. Have you never seen delirium produced, or any bad results, from the administration of salicylic acid?—Never from salicylic acid. At present people suffering from rheumatic fever when they are taking 10-grain doses of salicine every three hours or salicylate of soda have delirium; but I have never seen any bad result from salicylic acid. However, I have not given it in rheumatic fever or cases of that sort; I have given it to persons who were otherwise healthy, except for bladder diseases.

3108. Would you consider that the existence of renal disease contra-indicates the exhibition of salicylic acid?—I think just in the same way it would contra-indicate boracic acid, because it is excreted undoubtedly by the kidneys, and in certain diseases of the kidneys you do not wish to excite them.

3109. With regard to the use of salicylic acid as a preservative, may I take it that you would again agree that if it is used as a preservative the nature of such a preservative and its amount should be stated?—Yes, I quite agree, too, in that.

3110. Of course, you know that salicylic acid is a somewhat dangerous drug—a somewhat risky drug—to administer, and that it has often produced delirium in cases of rheumatic fever?—Yes, but then it is very difficult to know whether it is the fever or the salicine. You know you must not always blame the medicine.

3111. May I read a passage from Dr. Mitchell Bruce's *Materia Medica?* "Larger doses may cause delirium, especially with visual hallucinations; respiration is temporarily disturbed; the heart is depressed after the primary excitation; the vessels are relaxed, and the blood-pressure falls; perspiration is increased; the peripheral nerves, both sensory and motor, are unaffected."—That is the ordinary effect of large doses of salicylate of soda; that is why you give it in rheumatic fever to reduce the tension and to reduce the blood-pressure.

3112. However, you would be an opponent of the indiscriminate use of both boracic acid and salicylic acid?—Certainly, I would never advocate the indiscriminate use of either.

3113. About how much salicylic acid would you allow as a preservative?—On an occasion in which I gave evidence the other day there were about two grains in a pound of jam. I swore that in my opinion—and I have that opinion, for, of course, I would not have sworn it otherwise—that that was absolutely harmless.

3114. Two grains in a pound of jam?—Yes. That was absolutely harmless, and that was an efficient preservative, you see. It was absolutely harmless, in my opinion—in fact, I am certain that it is harmless.

3115. You do not think anyone would like to take a pound of jam?—I think that the pound of jam would do more harm than the two grains of salicylic acid.

3116. Could you give the Committee any idea of the maximum amount of salicylic acid which you would regard as safe in wine?—I should think that 10 grains in a bottle would be a safe quantity to use—10 grains in one of those quart bottles of wine, I mean. I think that is the quantity. I daresay you have access to the reports of my evidence, some seven or eight years ago, where there was a question of salicylic acid in raspberry wine. I think it was about 10 grains to the pint; I gave it, as my opinion then, that the 10 grains were harmless, and the summons was dismissed.

3117. How much salicylic acid do you think should be the maximum allowed in a bottle of cider?—I should think 10 grains would be quite enough. If I were going to draw up a scale I should put down 10 grains.

3118. In a bottle of beer, how much?—I do not know that there would be any difference—about 10 grains; a quart bottle, I mean, of course.

3119. Suppose a patient took a bottle of claret, a bottle of cider, and a quart bottle of beer, he would take 30 grains?—He would.

3120. Do you think that would be risky?—I do not think it would do him as much harm as the alcohol which he took with it.

3121. Would it be risky to anyone with renal disease?—Of course it would, but you know the alcohol in it would do him a great deal more harm than the salicylic acid.

3122. Do you think the amount of alcohol there would?—Yes. The three bottles—a bottle of cider, a bottle of beer, and a bottle of claret—would do him more harm than the salicylic acid.

3123. With regard to formic acid, can you give the Committee any information?—With regard to formic acid, within the last year—and it is only within the last year that I have used it—I have prescribed urotropine. I have used it very largely in bladder diseases, because I have found it is very good for purifying the water, and 10-grain doses three times a day are absolutely innoxious, and easy and pleasant to take—in fact, I have taken it myself to try the effect of it. It dissolves quite easily, and you can take it on an empty stomach or on a full stomach.

3124. Could you tell the Committee what the relation of formic acid is to formalin?—No, I do not quite know; this is called formic aldehyde, I think.

3125. Formic acid we have on your synopsis?—I have not given formic acid itself ever in my life. This preparation is called urotropine, and is a preparation of formic acid and ammonia, as Squire gives it. I do not know how it is made. I think it is one of those German preparations which has been compounded; it is not a Pharmacopœia preparation.

3126. (*Dr. Tunnicliffe.*) It is hexamethylin-tetramine, and decomposes into formic aldehyde?—Yes; I believe it is a preparation of formic acid.

3127. (*Professor Thorpe.*) But not pre-formed formic acid?—You know more about it than I do. I do not know anything about the chemical procedure; all that I know is that I have given a goodish quantity of it, and I have got patients taking now 10 grains a day with good results.

Mr. T. Bond.

20 Dec. 1899.

3128. May I ask whether you know otherwise that formic acid is an antiseptic?—I do know that it is an antiseptic.

3129. Formic acid is an antiseptic?—It is common knowledge, I think, that formic acid is an antiseptic—at least, I have learnt it; where I have learnt it I do not know. I have never tried it, but it is knowledge which I have gained somehow or other. I do not say that it is accurate knowledge, like the knowledge that I have picked up. It is only secondhand knowledge, certainly.

3130. (*Dr. Bulstrode.*) Then, to revert once more to salicylic acid, as I understand, you see no danger in the more or less indiscriminate use of 30 grains of salicylic acid?—Ten grains in a certain quantity of wine I said—ten grains in a quart; I do not see any harm in that. I am quite ready to take 10 grains of salicylic acid three times a day for a month. I did once for acute sciatica.

3131. Your kidneys are sound, I hope?—Very; they are quite sound—there is no albumen at all.

3132. (*Professor Thorpe.*) I should again like to ask you a question or two about the formic acid. I think you said it is a well-recognised antiseptic?—No, I corrected myself afterwards; I said I thought it was common knowledge that it was an antiseptic. I have seen it advertised as an antiseptic; but I really cannot say that it is an antiseptic from my own knowledge, because I have never used it.

3133. You are not, may I ask, making any confusion between formic acid and formic aldehyde?—No. I have never used formic acid at all, nor have I used formic aldehyde, as far as I know. The only experience I have of any preparation which may be called a formic acid preparation is the urotropine; that is the only experience I have had.

3134. That you regard as a formic acid preparation?—I understood it was, until you have corrected me to-day, a formic acid combination; but I do not know the chemical composition of it really, and I never saw it until about twelve months go, when I was recommended to it; but since I have used it largely.

3135. (*Chairman.*) I think we may understand from your evidence that you disbelieve in any direct action of borax upon the digestive functions?—I think it retards decomposition of the food in the stomach. I have known, in heartburn from decomposition and acidity, boric acid do good, but then I think it is just equally probable that if one were treating a case of irritable digestion one might do harm. Of course, digestion is a very complex process. A slow digestion, with decomposition and a great deal of flatulence, will be a proper condition in which to give boric acid, and I believe it would do good; but if I had an irritable stomach, I think it would do harm.

3136. Because it alters the food substance—because it hardens it?—I should decidedly say that it would prevent decomposition of the food.

3137. Does that apply equally to all these preservatives?—I should think so; certainly, it would to boracic acid; I cannot tell you with regard to salicylic acid, as I have never given salicylic acid for indigestion in my life. I have given boric acid for indigestion—atonic dyspepsia.

3138. Have you given any attention to colouring matters?—No, never.

3139. You are not prepared to give any opinion upon that?—I know nothing about the colouring matters which are used in food.

3140. (*Dr. Bulstrode.*) I understood you to say there are certain conditions of indigestion which would, in your opinion, contra-indicate boracic acid, and in which it might do harm?—Yes, certainly.

3141. So that would be another class of cases?—Yes, a class of cases where you would say, You are not to eat bacon, or ham, or cheese, or anything of that sort.

3142. But, of course, with bacon and ham one knows what one is eating, but if one does not know the existence of something which is detrimental to one's health, that might be a reason for requiring it to be stated?—I quite agree with you. My answer is quite straightforward—that I believe that with an irritable and inflamed stomach boric acid might do harm.

3143. (*Dr. Tunnicliffe.*) Are you aware of the fact that salicylic acid is constantly given in indigestion?—No, I

Mr. T. Bond.

20 Dec. 1899.

am not aware of the fact; you must recollect that I am not a physician; I am a surgeon.

3144. (*Professor Thorpe.*) Are these kidney troubles, renal troubles, very prevalent in your experience?—I get a very great number of them, because I treat a great number of bladders and enlarged prostates. For many years I was out-patient surgeon in Westminster Hospital. I do not want to exaggerate, but certainly I had then a very large number of people who had enlarged prostates. I have treated many hundreds of enlarged prostates. These old men I used to give boric acid and salicylic acid constantly, and tell them to go on with it. I never gave them any limit as to how long they should take it. I did not tell a man to take it for a week and then not to take it any longer. I gave him his medicine, and he could go on with it as long as he liked.

3145. What I rather wanted to gather are the conditions in which boric acid would be contra-indicated; are they pretty widely prevalent in the community?—Would you repeat the question?

3146. Are the conditions in which the administration of boracic acid would be harmful fairly widely prevalent in the community?—No; certainly you could not say that albuminuria was widely prevalent, but it is widely prevalent in the class of cases which I treat—that is, for prostatic disease. I have not made a condition of albumen a bar to its employment, because I have found really that, albumen or no albumen, they are mostly able to bear it, and that they take it, and that it does them a great deal of good.

3147. (*Dr. Bulstrode.*) Do you know that there were nearly 11,000 deaths from diseases of the kidney in 1897?—I did not know it.

3148. Would that not rather answer Professor Thorpe's question that there is a considerable class on which the administration of salicylic acid and boracic acid would be contra-indicated?—11,000 in London, or in the whole of England?

3149. Those are the deaths in the whole of England?—I should not consider that a very large proportion.

3150. What do you consider to be the fatality rate of the various forms of renal diseases?—You ask me a question which I have not studied at all.

3151. Should you say that 12,000 deaths represented a considerable amount of illness?—Yes, 12,000 deaths would represent 12,000 cases of illness, of course.

3152. But these are fatal cases of illness; what about the non-fatal cases?—These renal diseases are always fatal in the long run.

3153. There are many cases which have disease of the kidneys for more than a year?—Yes, they go on sometimes for ten years.

3154. Those would represent a considerably greater number than the 12,000, would not they?—Yes, but they die of renal disease at the end, you know.

3155. Then, of course, it is conceivable that the indiscriminate use of preservatives might possibly hasten their end, is it not?—Yes, you can put it in that way—it is quite possible that it might.

3156. The conditions of indigestion which you consider contra-indicate the administration of boracic acid may be fairly widely distributed, may they not?—They are generally brought on by alcohol or excesses; it has generally been alcohol. They are distributed widely enough. I have attended plenty of men with irritable stomachs from alcohol.

3157. Do you know also that the use of borax is supposed to be contra-indicated in pregnancy?—No, I have not the slightest idea of it.

3158. Will you take it from me that that is given in Lauder Brunton?—Yes, I will take it from you. I will take anything from you; you would not say so if it was not true.

3159. Do you know how many births there are in England?—No.

3160. Do you know there were nearly a million births last year?—No.

3161. Would that not point to a large distribution of other people who may be affected by this drug?—You are asking me about things that I know nothing about, you see. I do not know anything about the effect of it in pregnancy. If Lauder Brunton says so it is his opinion, it is not mine.

3162. Have you any reason to disbelieve it?—No.

3163. (*Dr. Tunnicliffe.*) Do you consider that every case of renal disease contra-indicates the use of boracic acid?—No, certainly not.

3164. (*Chairman.*) Pardon me if I ask you one more question. Milk is very often prescribed as a diet for invalids?—Yes, very often.

3165. In cases of albuminuria?—Yes, constantly.

3166. In your opinion is it important that the physician should be aware whether the milk taken by the patient contains a preservative or is perfectly fresh?—Yes, I think he ought to know.

3167. That indicates an opinion on your part that notification of preservatives ought to be made?—Yes, you can take that as my distinct opinion.

TWELFTH DAY.

Thursday, 21st December, 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.

H. TIMBRELL BULSTRODE, Esq., M.D.

CHARLES J. HUDDART, Esq., *Secretary*.

Mr. JAMES BRIERLEY, called; and Examined.

Mr. J. Brierley.

21 Dec. 1899.

3168. (*Chairman.*) I believe you are a Fellow of the Chemical Society, a Member of the Society of Public Analysts, and Public Analyst for the County Borough of Southampton, and for the Borough of Newbury?—Yes.

3169. I think you have devoted some attention to the presence of preservatives in food?—Yes, I have.

3170. Can you give the Committee the benefit of your experience?—So far as my experience has gone during the past twenty-five years I have only found these preservatives in milk, wine and butter; and with the exception of the wine only formalin and boric acid preparations were used.

3171. Have you taken samples of other materials also?—Of course, I have nothing whatever to do with the taking of the samples, but I have examined samples of other articles as well.

3172. Have you examined samples of bacon?—No, that would not come under the Food and Drugs Act; that would come under the Medical Officer's Department.

3173. In the course of your experience, extending over twenty-five years, have you found that the use of these preservatives is increasing?—Yes, I think it is increasing. Of course, during the last ten years it has been used much more largely than formerly.

3174. Take first the case of milk; have you any notes of the quantities found?—I have not any notes of the quantities found, but I think what I have is better, that is the statements of those who use it themselves; and from their own statements the quantities used are large. Only last week I was called in to a case in regard to milk between a farmer and a dealer that purchased from him. I found then that the practice in my neighbourhood, that is, outside the borough, was in the summer months to take one pound of the preparation, dissolve it in one gallon of water, and add one pint of that to eight gallons of the milk. That would give about 100 grains of the substance to the gallon, or a little over 12 grains to the pint. That seems to be the ordinary practice in that neighbourhood.

3175. Can you tell us if that is, in your opinion, more than is requisite to preserve the milk?—I think it is more than is requisite, certainly, because I find that even 35 grains to the gallon of boric acid, or of boric acid and borax mixed together is a very good preservative.

3176. Do you know how long that keeps the milk?—No. It would depend upon conditions. If you go into the poorer neighbourhoods, what are called the slum neighbourhoods, and see the conditions under which the milk is kept, you would wonder that anything at all would preserve it.

3177. At what time of the year is this done?—In the summer months; in the winter months we scarcely ever find it.

3178. Does the preservative retard the action in all kinds of change?—It seems to have a greater effect upon some of the bacteria than upon others. Consequently we get complaints that the milk which has been treated with these preservatives does not go off in the ordinary way, that is, does not go sour in the ordinary way, but that it "turns bad" as the people say. They often come to me with milk, and complain of the smell from it; it does not smell like "sour milk," but like "stinking milk"—that is the term they very frequently use.

3179. Would it interfere much with the milk trade in your district if preservatives were prohibited or severely restricted?—The only interference would be that the dealers would have, I am afraid, large quantities of milk thrown upon their hands as useless. You see the milk is frequently conveyed from the farm of an evening after milking to the station; it stays on the station platform all night very frequently, and is brought into town the next morning, and sometimes not delivered then until the afternoon delivery.

3180. That is a question of organisation, is it not?—It is a question of organisation, as you have said.

3181. Is that milk ever pasteurised?—No, the most that is done to it is refrigeration besides the treatment with a preservative.

3182. What regulations would you suggest?—I should suggest that the preservative be limited to formalin; I think formalin is used in the smallest quantity. I may say that we know nothing at all about a medicinal dose of it; but relatively the quantity required is much smaller than in the case of the other materials, and if it were used in large quantity another point is that it gives off an unpleasant odour, and people would therefore object to the use of the milk containing it.

3183. Would you think it would serve any useful purpose if a declaration were required of the presence of a preservative?—That might be useful, but there appears to me a difficulty in this way: Suppose that a preservative is admitted, and the quantity is prescribed, and say here is a farmer who puts in the amount that he is entitled to, it goes from the farmer to a large wholesale dealer; he also puts in the same amount—and then from the large dealer to a smaller one, who repeats the dose; then probably he sells, as is frequently the case, to a little dealer, who takes perhaps a gallon of milk from him, and exposes it on the counter in his shop; then that person might be caught, although he had had nothing to do with adding the preservative to it, because the quantity is over the amount fixed. There would be three people concerned in it, and almost all of them are sure to deny it on oath—from my experience. Then whom are you going to punish?

3184. That is taking an individual case?—Yes.

3185. But if the system were established that it was illegal to use a preservative without a declaration—that is to say that the farmer would be prohibited from sending his milk to market unless he declared the presence of a preservative—what would you say then?—That would check it undoubtedly; that would check the quantity used as well.

Mr. J. Brierley.

21 Dec. 1899.

3186. It is not in the interest of any person through whose hands the milk passes to add a preservative unnecessarily, is it?—No, not at all; I should not say so.

3187. It is simply an added expense?—Yes.

3188. Is it the practice generally among the farmers in your neighbourhood in Hampshire to add preservatives?—It is the practice among some of the farmers, but it is more a practice among large wholesale dealers. I know of one wholesale dealer who uses formalin regularly in the summer months, but not in the winter.

3189. I think you mentioned butter as one of the substances in which you find preservatives?—Yes. I have found boric acid in that, and I do not think that the use of preservatives in butter is at all necessary. The great fault with butter is the bad making of the butter—that is the secret. I may illustrate it in this way: I remember a case that came under my own knowledge, in fact it occurred to myself. Some relatives of mine in Cornwall sent up a couple of jars of butter; I think they weighed some 14lbs. each. One of the jars was broken in transit; that butter was taken out immediately it arrived, the broken pieces of the jar were removed, the butter was washed, and re-worked up, and repotted down without any addition whatever, not even any salt added to it, and that was used until it was finished. When that was finished the jar that had never been touched was opened, and the butter was found to be unfit for use; decomposition had taken place to such an extent that we could not use it; the only thing we could do was to put it into hot water and melt it down, and use it for cooking purposes.

3190. Your inference being that the butter milk had been removed from the broken jar?—Yes, in working it the second time.

3191. Have you found in many instances preservatives in wines?—The only case of preservative in wine I know is salicylic acid in sherry.

3192. In what proportion have you noticed it?—The quantity I did not determine. It was sufficient to show that it did not comply with the requirements of the Pharmacopœia. It was submitted to me specially to see that it did comply with the requirements of the Pharmacopœia, and salicylic acid was present. I may say that 50 cubic centimetres of the wine were operated upon, and it was distilled with acid in an equal volume of water. The first 10 cubic centimetres were rejected, the remainder were shaken up with ether, the ether separated and evaporated to dryness, and that left a residue which gave me a reaction for salicylic acid; but the amount was not weighed.

3193. Was that with a high class wine or a low class wine?—It should have been a very high class wine. It was rejected and sent back by the owners, and a sample was obtained then direct from Cadiz, which was perfectly free from salicylic acid.

3194. Had the acid been applied by the producers or by the Spanish vendors?—I cannot say; this sample came from London, and it was bought through a large wholesale house in London.

3195. In cask or in bottle?—In cask.

3196. (*Professor Thorpe.*) Beginning with the sherry, may I ask was it a plastered wine?—I did not examine it to see if it was plastered, but simply to see if it complied with the Pharmacopœia, because it was to be used for pharmaceutical purposes. Only 4ozs. were submitted.

3197. You stated, in answer to the Chairman, that you have not examined samples of bacon?—No, I have not.

3198. Because they came rather within the purview of the Medical Officer of Health?—Yes.

3199. Why does it not come within your discretion?—It is not an "article of food," and the addition of those preservatives to the bacon would not be an adulteration of bacon.

3200. Is not bacon an article of food?—It is, of course, an article of food, but it is not an article of food as defined by the Food and Drugs Act, and it is never treated as such. Suspected bacon is generally treated when it comes before the Medical Officer as an "article unfit for food"; the question of its adulteration has never been brought to my cognisance.

3201. Surely we have had cases in which hams and bacons have been brought within the operation of the Food and Drugs Act?—I do not know of any case.

Mr. J. Brierley.

21 Dec. 1899.

3202. Were there not some very notable cases in South Wales, where the question of the addition of boracic acid was raised as being the addition of something not of the nature, substance, and quality demanded?—In the bacon?

3203. Yes?—I do not remember seeing the cases.

3204. At all events in connection with hams?—I do not remember; it may have been.

3205. There was one such case, and a very notable case?—How long is that ago?

3206. Not very many years; I think it was at Pontypridd?—I know there were some cases of baking powder there. Dr. Morgan, I think it was, was concerned in that, but I do not remember a bacon case.

3207. It was, if I may say so, as a matter of fact, and it was quite a celebrated case. In your experience is the use of preservatives increasing?—It is increasing.

3208. Are all preservatives increasing very much in the same ratio?—When I say increasing I do not mean to say that the amount added is increasing, but the number of people using them is increasing; and it is more difficult in the summer months to get samples that are free from those preservatives than it used to be.

3209. I understand that; the prevalence is increasing?—Yes.

3210. Which preservative do you think is being increasingly used, or would you say the use of all of them is increasing?—Both formalin and boracic acid preparations are being increasingly used.

3211. And in equal amount?—I should say so.

3212. With regard to the case you gave us in which the dealer had added an unusually large quantity, surely that was greatly in excess of what is prescribed by the printed directions which are given to him, is it not?—According to his statement he said it was what they were recommended to use. The printed statements are not always followed. I find that there are agents for those makers who go about and canvass for customers, and they give them information on their own account, which is not the prescribed amount.

3213. You say, I gather from you, that the practice is to use those things in a larger quantity than the actual makers of them declare is a sufficient quantity?—Yes.

3213*. Is it within your experience that that is so?—I should say so from this case—that is the only case which has come within my knowledge, but there is also the case where it is used, perhaps two or three times over.

3214. And may be used in the same free-handed way?—Yes; in fact I find that in Southampton there are chemists who are selling boric acid pure and simple, without any instructions whatever to these people, for the purpose of adding to milk. It is sold to farmers in that way. One chemist and druggist whom I know told me he sold large quantities of it.

3215. You indicated that of the two preservatives you mentioned you had a preference for formalin as against boracic acid?—Yes.

3216. But surely formalin is by far the most potent as a drug, is it not?—I do not know. We do not seem to know anything of its potency as a drug; the only man that I remember saying anything about having tried it even on one individual person was Dr. Rideal, and he took rather a large quantity of it.

3217. Are you not aware that it has a very specific action upon albuminoid substances?—It may have outside the body, but we know nothing of its action inside. I remember Dr. Rideal saying that to the Sanitary Congress at Southampton; I was present when he made the statement. I forget the amount he stated, and I have not the figure here. I do not know whether Dr. Rideal has been examined here, has he?

3218. No. Have you experimented yourself with formalin?—No. I have not experimented with any of them for this reason, that if you try these things on single individuals the inferences are not to be relied upon. For instance, take a common egg. I know three people, two of them medical men, who cannot touch an egg or anything containing egg; it acts upon them like an irritant poison. Now, one would never conclude that because there were three people affected by eggs in that way, eggs were not suitable for food. And you can go through the whole range of foods almost and find similar cases of peculiar idiosyncrasies in people; and hence it is not fair with one or two people trying the experiment in this way to draw inferences that should apply to the general public.

3219. I was not suggesting that you should make experiments upon individuals, and was referring to the specific action of formalin upon such proximate constituents of food as it would be likely to act upon; how far, for example, it was likely to affect digestion, or how far it was likely to affect the specific characters of proteid and albuminoid substances?—I think some of the experiments that Dr. Rideal recorded that day at Southampton went to show that the quantities he used interfered much less than boracic acid, and much less than alcohol, I think it was. They were actual digestive experiments, carried on outside the body.

3220. (*Chairman.*) I am going to ask a question as an ignorant man. You will admit, I think, that formaldehyde has a hardening effect upon certain tissues, certain substances?—I should think so—if you use the raw material. It is just the same as with alcohol, which has an extremely hardening effect, although the diluted alcohol has been shown over and over again, sometimes to rather aid digestion than to interfere with it.

3221. I am not talking of digestion at this moment. You have drawn the distinction between a substance outside the body and a substance inside the body, and I want to get at what is in your mind. When you add formaldehyde, or whatever the substance is, in a proportionate quantity, together with the preservative effect, there is a hardening effect, is there not?—It must be infinitesimal, because the quantity used in the case of formaldehyde is, I believe, about .012 per cent.

3222. But in proportion to the effect, whatever that proportion may be, the effect outside the body would be the same as that inside the body?—I do not admit that.

3223. You do not admit that if you harden certain food substances, and so alter those substances, that it makes them less digestible?—I may put it in this way: Suppose you were to take an ounce of beefsteak and treat it with a certain amount of formalin; I do not admit that the effect of the formalin on the beefsteak outside the body would be the same as if it were taken into the system. It might harden the steak outside, but it does not follow that it would interfere with the digestion inside. Alcohol, as I have said, has a hardening effect, but the hardening effect is not proportionate to the amount. What I mean to say is that if you add a 50 per cent. solution of alcohol it does not follow that there will be double the effect—it may be eight or nine times the effect—if you use absolute alcohol.

3224. Pardon me; you do not seem to quite apprehend what I mean. As I understand your position, it is this: the application of formaldehyde to food outside the body has a certain effect?—Yes.

3225. Food taken internally, followed by a dose of formaldehyde, in your opinion, would not undergo the same change?—Certainly not; it does not follow that it will.

3226. But food that had been treated outside the body with the preservative and then swallowed?—Would be influenced to the extent that it affected it outside the body.

3227. (*Professor Thorpe.*) Coming again to that point, formaldehyde acts upon the tissues of the beefsteak?—Yes.

3228. Would it not equally act upon tissue which happened to be of the temperature of blood heat?—It all depends upon the circumstances. When you take these tissues into the body there are other materials present that may modify the influence of the formaldehyde considerably. We know nothing of the action of the gastric juices or of the saliva even on these bodies.

3229. I will not enter into that; I will leave that to Dr. Bulstrode to deal with. May I take it, however, that your knowledge of formaldehyde is practically limited to what you have been told by Dr. Rideal?—All I know of its action is the knowledge that I learnt from Dr. Rideal through his paper at Southampton. But there is this much I may say—and perhaps this to my mind appears of more consequence—during the last two years I have been supplied with milk from two sources; from one source I know that the milk is absolutely free from preservative all the year round; from the other source I know equally that in the summer months formalin is used; consequently, I have two years' use in my own house of this milk with formalin added to it, and I must say that there are no signs of any injurious effects resulting therefrom.

3230. (*Dr. Bulstrode.*) Do you know that formaldehyde has been used as a preservative for fish?—I do not know that it has. I know nothing of its use outside milk even.

Mr. J. Brierley.

21 Dec. 1899.

3231. You do not know that it has been alleged that the use of formaldehyde as a preservative in fish has had to be given up because of its hardening effect upon the fish?—No, I do not. I have heard of its being used, but I have not heard of the result.

3232. Would you say that the hardening effect which formaldehyde is stated to have upon certain foodstuffs would influence their digestibility when taken into the human body?—I should say so if the hardening took place to any appreciable extent.

3233. Would you say that if what I am stating is a fact, that would be an argument against the use of formaldehyde?—I should like to ask one question with regard to that, and that is, what was the strength of the formalin solution used?

3234. It was, I think, something about one in 50,000, but I cannot speak positively?—Then it is very dilute.

3235. You are not aware of that statement in a paper by, I think, Dr. Alfred Hill, in the Proceedings of the Sanitary Institute. I am not sure that I am right as to my quantity, but I am right as to the fact that the use of formaldehyde has been given up because of its hardening effect upon the tissues?—Upon the tissues of animals such as fish?

3236. Yes. How many samples of milk do you examine for preservatives during the year?—I just looked over my book before I started off this morning. I think the number submitted to me by the inspectors was seventy-nine, and of those seven were found to be adulterated, that is, with water or by skimming.

3237. Seventy-nine, do you say?—Seventy-nine at the outside; and I have had thirty-nine submitted privately, and I may say that of those nineteen were returned as adulterated.

3238. How many contained a preservative?—I could not say exactly, but it was not the whole of them. The preservative is only used during the summer months, and then almost everyone would have either a formalin or a boric acid preparation. I did not look for those during the summer months.

3239. Have you had much experience in the examination for preservatives of directly imported products at Southampton?—The only thing is milk. Imported milk does contain formalin in much larger quantity than is used in this country.

3240. Have you found formalin in much greater quantities in directly imported milk than you have found it in milk produced in this country?—Not by actual determination, but by simply comparative results.

3241. By what means do you procure the directly imported samples?—In that case I do not know whether they were obtained by the aid of the Excise authorities or not, but one of our inspectors went down to the Docks and took a sample direct from the can or cylinder, in which it comes into the country. I may say that that sample was being supplied to dairymen in Southampton; it was not coming away here to town.

3242. How many samples are you basing your general statement upon that milk imported directly from abroad contains a greater amount of preservatives than milk produced in this country?—I think there were three samples.

3243. Those are all that you have tested?—Those are all that I have had submitted to me for analysis.

3244. Have you made any examination of cream for preservatives?—No; I do not think I have had a dozen samples of cream during the past five years.

3245. Do you think that 35 grains per gallon of boracic acid would be a dangerous amount to use?—I cannot say. I can quite conceive that in some conditions and in some districts instead of being dangerous to use it would be beneficial. I will put it this way: I know from returns and from the reports on inquest cases that owing to the conditions under which the children live and the unsuitable food, they are liable to an aphthous condition; if you like to put it in simple words, we will say they are liable to thrush; and we know that boric acid is a very good remedy for thrush. I can quite conceive that the presence of boric acid in the milk supplied under such conditions in such a district might prove beneficial rather than hurtful.

3246. Do you know the pharmacopœial dose in the case of boric acid?—No. I thought this morning I ought to look at the Pharmacopœia before I came up.

3247. If you were told the dose is from 5 to 15 grains three times a day for an adult would you say that 4½ grains per pint in milk was a safe thing for quite young children to take?—I should not think it was, but I do not think young children of the poorer classes get that amount of milk; it is very much diluted.

3248. Do you not think that the children of the poorer classes would be likely, under the practices now prevalent, to get 4½ grains of boracic acid in their milk?—Not in a day; I do not think they would get a pint of milk a day.

3249. Really?—More frequently I think you will find amongst the poorer classes of people in manufacturing and large towns that they are confined to a half-pennyworth or a pennyworth of milk a day.

3250. Take the people who are fortunately better on, would you think that they would resist, we will say, three pints of milk, with 4½ grains per pint per diem?—I should not like to give children of mine that amount.

3251. You would not like to do it?—No, I should not.

3252. You would think that is a reason for controlling it, even to a greater extent than 35 grains per gallon?—Yes. I may say that I have not fixed any definite amount in that way; I wish that to be clearly understood. I say we have no real knowledge as to what the definite amount that should be allowed is, and for this reason, that we have no really extended observations as to the effect of these milk supplies containing these preservatives over large towns. I think in a letter I wrote to this Department I suggested one or two things. One thing I suggested I believe was that the consignments of milk to, say, an orphan asylum, or a maternity home should be watched, that every consignment should be sent to an analyst and examined specially for its preservatives, and that at the same time the medical officer of such an establishment should be asked to take notes of the general health of the children supplied with this milk. In that way I think we should get very much better information than we get from laboratory experiments or general inferences.

3253. May we take it from your observations as regards the decomposition of milk that you do not regard the lactic acid changes as a fair indication of the decomposition going on in milk?—Certainly not, especially those to which preservatives have been added. I think the lactic change is retarded, and that other changes may go on which are not retarded to the same degree.

3254. Do you think the other changes might be as detrimental as the production of lactic acid?—Certainly. I will tell you what my wife has told me. She preferred a sour milk—that is a milk that went sour—to some of this milk with preservatives in, which did not go sour in the ordinary way. That was because of the unpleasant smell.

3255. (*Professor Thorpe.*) Had that reference also to the milk which you told us of which contained formalin, and which your family enjoyed?—Yes; they used it and found no ill-effects from it.

3256. (*Dr. Bulstrode.*) Why do you say that the amount added should be such as will keep the milk fresh for not longer—if I read your synopsis correctly—than sixty hours?—I think I have put sixty hours, and I think I have given a very wide margin. I do it for this reason. Under the present conditions of the milk supply to the large towns particularly, it is utterly impossible that the milk should be delivered, as in my opinion I should like to see it delivered, that is to say, milked this morning and delivered with this morning's delivery. That is an utter impossibility. It has to travel by railway; it is subject to a high temperature, and an enormous amount of churning, and consequently it is absolutely necessary if the milk supply is to be kept up under those conditions that something should be added to it, or that something should be done. I do not altogether say that it is necessary to add preservatives. For instance, from my laboratory windows I can see thousands of gallons of milk every day being carried into a refrigerating establishment to be refrigerated and sent out to South Africa. It goes away to South Africa, kept in the cold chambers on board ship, and comes back, and is perfectly good when it comes back; but it has to be thawed before it is used.

3257. Do you think a larger amount of boracic acid or other preservative would be necessary to keep milk for sixty hours than would be necessary to keep it for twenty-four hours?—Yes, I do.

3258. Would you think that twenty-four hours was not the fair time limit to place upon the keeping of the milk?—If I were asked what I would like I would prefer twenty-four hours to sixty, certainly, if it could be done.

3259. May we take it from your synopsis that you

Mr. J. Brierley.

21 Dec. 1899.

think the addition of preservatives to wine unnecessary?—Yes.

3260. Would you tell the Committee why you consider it unnecessary?—Because wines can be obtained without them, and till lately these preservatives have not been added to wines.

3261. Could you give the Committee any idea about what dates preservatives began to be added to wines?—I believe that a great many of these preservatives have sprung up entirely since the beginning of the Food and Drugs Acts. I do not think in the early days of the Food and Drugs Acts many of these preservatives were used.

3262. How was the supply of milk carried on before the introduction of preservatives?—The supply of milk, I believe, was very much more rapid. The farmers who now send their milk into town by train brought it in themselves direct from their farms in carts, and delivered it much more frequently than they do now.

3263. (*Chairman.*) The supply of milk generally is much more copious now, is it not?—Yes, I think it is. Of course, there is this about it. I believe a great many farmers did not send their milk into town at all, but simply made it up into butter. I may give you an illustration of my experience with regard to that in North-East Lancashire, which is my home. I have had relatives there whose families farmed the same farms for centuries, and I know it was their practice for a great number of years, almost the whole time I have known them (I do not know that it is now) never to send milk into the towns at all; the whole of the milk was simply put to cream, the cream was skimmed off, and made into butter. The skim milk was then given to feed young cattle, and the butter milk to pigs; the butter was taken into Bury or Blackburn market—whichever proved to be the better market—twice a week.

3264. Taking your own town of Southampton, is it the case that the population generally have a larger supply, and a cheaper supply, of milk than formerly?—I do not think it is really any cheaper, but it is larger probably. We are able to get a cheap supply, but I think you will find that the cheapness is due to systematic and very scientific dilution. I do not know; it is simply a matter of opinion, but I believe that if we could actually get at the condition of milk before it comes into the town, and its condition when it is being served, half the samples that are now returned as genuine—and we cannot do otherwise, because we should simply be beaten if we went into court—would be found to be more or less adulterated.

3265. What I want to get at is whether in your experience the dwellers in towns have a greatly more ample supply of milk than they used to have?—I should say that with the growth of population in Southampton the supply keeps up to the same extent, and there is no more difficulty now in getting milk than there was when the population was very much less.

3266. Are you acquainted with the towns of Lancashire?—I have been away from Lancashire now for twenty-five years. I have only made a sort of annual visit in the autumn, as a rule.

3267. I do not want to ask you to answer anything that you cannot answer from your own knowledge. What I want to ascertain is whether you are aware of a freer milk supply to towns, and whether that freer milk supply is owing to the use of preservatives?—I could not say that of my own knowledge.

3268. (*Professor Thorpe.*) I should like to ask you two further questions with respect to the milk, which arise upon what you have just said. You spoke of imported milk coming into Southampton, I think?—Yes.

3269. Is there much imported milk now?—I cannot say whether it is still going on; I have not heard lately, and I have not been into the docks. The bulk of it was forwarded into town, but there was one dairy in particular that we knew took a certain amount of this milk, and my inspectors, I think, about a month ago told me that it was still going on.

3270. Is this milk which is imported from Cherbourg?—I do not know whether it comes from Cherbourg or Havre.

3271. It is French milk?—Yes, it is Normandy milk, I believe.

3272. Is its importation now stopped?—I am not aware whether it is or not, I cannot say.

3273. Is that the only sample of imported milk that you are referring to?—That is the only sample that I am acquainted with or know anything about.

3274. I think you said—you will correct me if I am wrong—that this use of preservatives had arisen since the passing of the Food and Drugs Act?—Yes. I do not think we knew much of them before. I know that the farmers I was acquainted with previous to that time never used preservatives, and I know that a great many who did not use preservatives then do now.

3275. Do you wish to imply that it is the result of the working of the Food and Drugs Act?—No. I rather think it is the result of the increased demand owing to the increase of population in the manufacturing towns.

3276. Then what has the Food and Drugs Act to do with it?—I was asked as to when it came in, and that was simply, I thought a convenient point to refer to.

3277. There is no connection between the two?—No, there is not; I do not suggest any connection at all between the two.

3278. (*Chairman.*) You have precisely answered what I was endeavouring to get from you before; you attribute the fuller supply to the increasing population, and to the use of preservatives?—Yes, and then people who formerly made use of their milk to convert it into butter, and to sell it as butter now send it direct into town as milk. There is another reason, viz., the low price of cereals, and the consequent conversion of arable land into pasture.

3279. Now, turning to colouring matters, have you paid much attention to them?—Only in butters. I find that the low class butters and the margarines are all more or less artificially coloured. The only test I rely on is that I find that a great many of these low class butters, and I may say all the margarines, if they are allowed to stand in contact with acetic acid give a peculiar pink colour distinct altogether from anything you will get from genuine butter. That is invariably the case. It is a colouring matter that behaves very much like what is known as methyl orange.

3280. May we take it that margarine is coloured to imitate butter?—Yes.

3281. And inferior butter is coloured to imitate superior butter?—Yes; there is no doubt about that.

3282. Do they use colouring matter in milk in your district?—I do not know of the use of colouring matters in milk in my district, but I know that colouring matters have been used previous even to the Food and Drugs Act. It was a common thing to add annatto even when I was a youngster, when I had the run, as I have told you, about these farms—not the one farm to which I was referring, where they made nothing but butter, but other farms where they sent in genuine milk; if it was pale at all, and people objected to the pale-looking milk, they would add a little annatto to bring up the colour.

3283. (*Dr. Bulstrode.*) Do you know anything as to bad results ever having accrued from the use of colouring matters of any sort?—I do not.

3284. If you were to set about an investigation to discover what might be the bad effect of colouring matters, what colouring matter would you choose?—If I were asked as to what colouring matter I would admit, I would say that annatto is the easiest and most simple one, and I have never known of any ill effects resulting from its use.

3285. That is speaking mainly in reference to one food stuff?—Yes. It is used in butter as well as in milk.

3286. Both practically dairy products?—Yes.

3287. Do you know anything of the use of copper in the colouring of peas?—With regard to peas, I have had samples of peas containing copper, and we have had prosecutions for them. I do not now remember the quantities offhand. It is a great many years ago that we had a prosecution in the case of coloured peas.

3288. Did you ever hear of any bad results accruing from the consumption of copper-coloured peas?—No, I have not.

3289. Or of any other copper-coloured vegetables?—No. I have heard of no evil effects; evil effects may have followed, but there has been no account of them.

3290. You say in your synopsis that the use of certain coal tar derivatives should be prohibited. Upon what evidence do you directly base that statement, or do you base it on general principle?—I base that on the general principle that a great many of the coal tar products are produced by the aid of arsenic, mercuric chloride, and

Mr. J. Brierley.

21 Dec. 1899.

similar poisonous substances. Of course you can quite understand there may be a trace of those substances carried right through the processes, and more or less contaminating the substances. I have never found it myself, but I think I have seen it that arsenic has been found.

3291. Arsenic in sufficient quantities to produce a poisonous result?—I cannot say that.

3292. (*Professor Thorpe.*) Do you know what actually are the colouring matters other than annatto which are used in butter?—I have known in a great many cases that formerly a very common colouring matter used in the North of England was saffron.

3293. That is a vegetable colouring matter; I was speaking more particularly of these so-called coal-tar dyes?—I only know what I have met with myself, and as I say it reacts very similarly to methyl orange—I do not suppose it is methyl orange—it is more likely to be one of the tropœolins.

3294. You do not know more specifically than that of what the thing consists?—No, I do not.

Mr. W. F. LOWE, called; and Examined.

Mr. W. F. Lowe.

3295. (*Chairman.*) I believe you are the Public Analyst for the counties of Flint, Carnarvon, Anglesey, and Denbigh, and also for the City of Chester?—I am.

3296. I understand that you have prepared for us a memorandum fully stating your views upon the use of preservatives in food?—Yes.

3297. I understand that you would prefer to hand that in as your evidence?—Yes, as I am deaf.

(*See App. No.* 16.)

Dr. M. KENT ROBINSON, called; and Examined.

Dr. M. K. Robinson.

3298. (*Chairman.*) I believe that you are Doctor of Medicine of the University of Erlangen, a Member of the Royal College of Surgeons of London, a Licentiate of the Apothecaries' Society of London, and a Licentiate in Midwifery?—Yes.

3299. You are the Medical Officer of Health for East Kent, I think?—Yes. That is a district comprising about thirteen sanitary authorities, with a population of about 130,000, and an area of 300,000 acres.

3300. Has your attention been drawn to the presence of preservatives in food?—It has; I have taken a considerable interest in the matter.

3301. Could you give the Committee any information on the subject?—The evidence which I can give to the Committee may be summarised in a brief statement of facts, which came under my observation in 1895. At the latter end of September, 1895, the 25th September in fact, I was requested to investigate a sudden and serious outbreak of illness in a religious house, containing five sisters, cook, and housemaid. Although no fatal results accrued, the symptoms were severe, including especially colic and protracted vomiting, with suppression of urine, and great prostration, involving protracted convalescence. Five out of the seven inmates were attacked within a short period of each other, thus indicating some common origin as the source of the mischief. Suspicion at the onset was attached to the milk supplied to the household, which the five who had suffered had partaken of, whilst the two who escaped had not so participated. The first two were attacked about five o'clock in the afternoon, the others suffering during the same night and following morning. I find on my notes here that at 5 p.m. on September 25th Sister Eliza was seized with severe colic and vomiting, the latter symptom continuing at various intervals for four days. On the same night Sisters Mary and Agnes were also attacked in a similar manner, the first in a less degree than the latter sufferer, in whom the symptoms lasted in a severe form for three days. On the following morning Sister Rhoda was attacked with the same symptoms, but not of equal severity, and on this day the housemaid was also attacked with colic, vomiting, and diarrhœa. In the worst cases there was suppression of urine, and recovery was protracted in all save one. Five out of the seven were attacked within twenty-four hours. The implicated milk was taken alone, blended with tea, or in the form of blancmange. To the morning and afternoon supply of the milk partaken of on the day of seizure the cook added a preservative known as "Glacialene." A sample of the packet from which the Glacialene was taken was analysed and found to contain, as its basis, boracic acid. A specimen of the milk supplied by the dairyman was also analysed, and found to contain also boracic acid. Thus, for the same purpose a preservative had been added to the milk, both before and after its delivery at the house, by which treatment an overdose was unintentionally administered. Permission was obtained to give the portion of non-consumed blancmange to nine fowls; five devoured the food with avidity, and thus secured a larger portion than the remaining four; the five were vigorous pullets, but all died. They were very voracious, on that account consuming more than the others.

3302. Were the milk and the crop also analysed for mineral poisons?—Yes; fortunately the milk taken on that particular day was retained by the Lady Superior, and I got the crop and gizzard of a fowl myself; that is, I made a post-mortem, and sent the organs named to the analyst. The blancmange was not analysed. The milk and other contents of the crop and gizzard were analysed. Antecedent to the analytical investigations, inquiry had been instituted at the dairy, and no illness at the dairyman's house or amongst the cows had been known to exist. On the premises where the outbreak occurred the water supply is pure and beyond suspicion, and the sanitary arrangements most satisfactory in character. After elimination of other causes the evidence pointed to boracic acid as the real factor which gave rise to the illness in these cases. I think those are the facts, and they can be verified if necessary. If you care at any time to have any of the Sisters, I presume they are alive, and if you care to have the medical man who called me to investigate the case with him, I daresay they could be produced.*

3303. You did not take a quantitative analysis of the milk?—No. It, of course, is a misfortune that the quantity was not taken. I may say that the analyst assured me that the boracic acid was found in considerable quantity. It permeated the crop, and it permeated the gizzard, and was found in even the deep structures of the layers of the gizzard.

3304. Are these symptoms those which you would expect to follow from taking borax or boracic acid?—Yes, I think so. The best known record I remember is that of Féré, I think, in Paris. He gave it, I think, in over a hundred cases in epilepsy, and the results of his record in those cases show conclusively that it is injurious. I have known it given medicinally, and with unsatisfactory results. Then, of course, it is well known to the profession that it has been used in surgical cases. The stomach, I believe, has been washed out with it, and serious results produced, and it has been used, of course, in surgical cases after an abscess as an antiseptic dressing, and there bad results have accrued. I fancy that the pleura has also been injected with it in some instances, but I am speaking from memory.

3305. The impression derived from this experience is that preservatives should not be used in milk or other food, is it not?—I have myself no doubt about it. I feel very strongly that boracic acid added to milk is a poison, and that it ought not to be so added. It is only a question of quantity. I regret exceedingly that at the time there was no quantitative examination made of the implicated milk in the cases narrated. All that I can say is that the analyst is a capable man. He is a vice-president of the Society of Analysts. He devotes his whole time to analytical work. I know he is a conscientious worker, and a man of experience, and I believe the results he arrived at were after careful analytical work. As evidence of that I asked him particularly to examine for tyrotoxicon (because that is sometimes found in the summer months in milk undergoing putrefactive change) in order that one might eliminate any other evidence. I know it

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* The Lady Superior has died since the occurrence of the poisoning, but the present one remembers all the circumstances.

Dr. M. K. Robinson.

21 Dec. 1899.

might be said, of course, that ptomaines, or other toxins, might have produced this, and not boracic acid; therefore, I was careful, as I generally am, to eliminate anything else which might be assumed to have acted in addition to, or at the same time, as the boracic acid acted.

3306. Is the religious house to which you refer situated in a town or in the country?—It is situated in Dover.

3307. Have you directed the analysis of any other samples of the milk supply of Dover?—Yes, I have, and I have expressed my surprise that preservatives were not more often found, because it does not coincide with the facts which have come under my own observation when going about with my inspectors in my several districts. As an example, I may tell you that when I go round the Isle of Thanet, where I have two districts, it is a common practice, and the dairymen admit, that they do add preservatives to their milk. The chairman of one of my sanitary committees recently said to me, "I quite agree with you, Dr. Robinson, preservatives ought not to be added to milk; but I supply milk wholesale to men in the Isle of Thanet, and they make it a stipulation that I shall add preservatives before it is sent there." I mention that because it is a fact which I think ought to be known to the Committee as affording evidence that preservatives are used to a very much greater extent than the work of the analyst has discovered. I do not attribute any improper motives, but I presume they may not have looked sufficiently for preservatives.

3308. I understand that the milk supply of Dover is to a large extent free from preservatives?—So far as the results of analytical inquiry are concerned it is; but I have other districts besides Dover.

3309. I mentioned Dover, because it is an urban district?—Broadstairs is an urban district, and I have to do with that; there I know that preservatives are used in the milk supply. They go under various names. Glacialene is one, and Arcticanus is another, which is in great favour in the Isle of Thanet. Arcticanus is supplied by someone near Southampton; the traveller comes round with it, soliciting custom amongst the dairymen.

3310. The basis of all being borax, would you say?—I do not know what is the basis of Arcticanus. I have asked our analyst to obtain samples, and analyse them, and report on it; but he says he has not been able to get a specimen.

3311. Have you any experience of the presence of formalin?—Formalin has only been recently used since public attention has been called to the addition of boracic acid. I presume—as is always the case in these instances—that when one thing is found out by the public the sophisticators go for something new, in order to avoid being detected. They know very well that boracic acid would be looked for in the milk, and therefore go for something else, and they have gone to formalin, just as in Paris, or at any rate in France, many years ago, if you remember, when salicylic acid was prohibited they went for, I think it was, benzoic acid. That is, of course, a common practice; they go to the chemist, and they say "Now, we shall be found out if we use this; you must discover something else that will not be found out." That is the natural result which follows upon knowledge being published, which is unfortunate from that point of view.

3312. Would you recommend that declarations should be made obligatory on the vendors?—Most decidedly; those preservatives are not added for the benefit of the consumers, they are added for the benefit of the vendors, and the consumers do not require them—besides there are plenty of other preservatives. These atrocious additions, what do they do? They simply enable the purveyor of milk to adopt very dirty habits, and they also conceal the initial stage of putrefaction, and they conceal also milk from diseased cows, that is to say, milk taken from diseased cows undergoes putrefaction, and is very much more potent for injury than good honest milk, which is milked from pure cows. These additions do conceal all those things. As a medical officer of health I should say that it is preferable that milk should undergo decomposition, as we should then know that something was wrong with it; we should then know that putrefactive or disease germs were at work; but this unfortunate sophistication precludes the obtaining of all that knowledge.

3313. (*Dr. Bulstrode.*) Do you attribute this outbreak of which you have given evidence to the milk used or the blancmange?—The blancmange was most potent, undoubtedly, as shown experimentally with regard to the fowls—the lady superior and the cook did not participate in the blancmange. I ought to say that the boracic acid was not detected in the blancmange, as there was no separate analysis made of the blancmange, but the milk with which the blancmange was made was derived from the implicated supply.

3314. There were seven people in the house?—Yes.

3315. Five only were attacked?—Yes.

3316. Did the remaining two take either milk or blancmange?—They had a small quantity of milk in tea or coffee. The lady superior and the cook told me they had a small amount.

3317. Those two had a small amount of milk, which, it may be inferred, produced the bad results in the others?—I cannot say whether it was milk wholly or whether it was the milk and blancmange both, because both milk and blancmange were taken.

3318-9. What was the blancmange made of?—It was made with ground rice, eggs, sugar, and boiled milk, flavoured with vanilla.

3320. You would then trace the bad effects to the milk constituents of the blancmange?—Yes, I think so because we have proof of two facts—one, that the milk from the dairyman contained boracic acid; and then, secondly, we have the admission of the cook that she added Glacialene to the milk, not to the blancmange, and we have the fact that the Glacialene contained boracic acid, as revealed by the analysis.

3321. Do you think it is possible, having regard to the fact that the two out of the seven persons who had some milk were not attacked, there may have been something else other than milk in the blancmange which produced the symptoms?—I am not prepared to say positively that it was not so, because the blancmange was not analysed; but I do know that the milk contained boracic acid, and I do know that the crop and the gizzards of the fowl contained boracic acid.

3322. Do you know anything as to the source of the milk supplied to the house on this occasion?—Yes. I visited the farm myself.

3323. Did you enquire into their habits as regards the addition of boracic acid?—Do you mean did I ask if the farmer himself added it?

3324. Yes, did you ask the dairyman whether he added it?—I did not ask him the direct question, because I went to his house before the analysis had been made, and therefore I was not in a position to either contradict him or otherwise, or to accept his statement.

3325. Is it your opinion that the milk when supplied to this invaded house contained boracic acid?—Undoubtedly.

3326. It did?—Undoubtedly; added by the milkman.

3327. And that caused the bad effects?—That, in addition to the boracic acid contained in the Glacialene, which was added by the cook.

3328. So that in all probability many more people around were taking milk which had been boracised by the dairyman, but they or their employés may not have added Glacialene containing other boracic acid?—Of course, I could not tell what the other consumers of milk did. I cannot say what they added, but this milk would have been sold to the other consumers. The peculiarity in this particular house was that the cook had bought Glacialene and added it to the milk supplied, which had been sophisticated by the dairyman.

3329. So that it was twice sophisticated?—Yes, and in that one respect it would differ from the milk supplied to the other consumers.

3330. Which was only once sophisticated?—I do not know how many times.

3331. Apparently it must have been once sophisticated?—It was analysed once; it was not analysed periodically.

3332. I mean that the milk which was sent out from the dairy upon that day apparently had had a preservative added to it?—I should say so, undoubtedly. I can tell you, as a matter of fact, that there were a very great many cases of diarrhœa and enteritis in the town amongst the children at that time. I do not say that there were deaths, but I am not prepared to say that some of those cases of intestinal mischief were not produced by this very milkman's milk to which boracic acid had been added. They were not enquired into because they were looked upon as cases of ordinary autumnal diarrhœa, enteritis, and so forth. I do not say that the symptoms were not exaggerated, and that some of the cases that occurred were not fatal in consequence of the addition of boracic acid.

Dr. M. K. Robinson.

21 Dec. 1899.

3333. You think it possible?—I think it is quite possible.

3334. You think it possible that the preservation of milk by boracic acid may produce infantile diarrhœa?—I think so; so much so is that my conviction, that knowing that the preservative you mention, Arcticanus, was largely used, I urged on the Thanet Rural District Council that they should instruct their analyst to examine the preservatives on account of the large number of cases of intestinal disturbance there. I said, wherever I go I find that Arcticanus is universally used, and I think that the analyst's attention should be directed to it to see if this large amount of intestinal disturbance is due solely to the ordinary autumnal causes or whether there are some chemical matters at work in addition.

3335. In your opinion, as a Medical Officer of Health, do you think that preservatives should be allowed in milk?—Certainly not; why should they? It can be preserved in other ways.

3336. Would you allow preservatives in milk provided the fact of their presence was stated?—No, certainly not, because I might take at my breakfast boracic acid with my kippered herring, with my butter, with my milk to my coffee; and then I might take some salicylic acid in my beer at luncheon time, and goodness knows how much I should have taken by the end of the day. Therefore, the quantity in the milk alone, although it might not be sufficient to produce any prominent symptoms, might be undermining my constitution, and injuring my digestive organs, and producing in me symptoms of indigestion.

3337. Supposing boracic acid were allowed in milk on the condition that not more than a certain amount—the minimum amount necessary to preserve milk for twenty-four hours—were added, and that in all cases the amount and nature of the preservative should be stated, would you object to that?—Certainly.

3338. You would?—Yes. 1 in 1,000, I believe, is considered the amount necessary to preserve milk; if you take the dose that a baby would get in the course of a day that would be considerably in excess of a baby's dose; say five grains, and therefore the amount required to preserve milk—I believe 1 in 1,000, but you know better than I do, I daresay—if taken by a baby in its bottle during the day would be sufficient to poison it. I do not say to kill it, but sufficient to produce great disturbance of the digestive organs; at least that is my opinion, and I base it upon the facts, which I believe are admitted.

3339. Do you know anything as to the experimental work in reference to the action of boracic acid upon the digestive processes?—I have seen the reports, and I have seen also the reports of men who have said that they have taken large doses of it, but I do not attach very much importance to that, because there are certain degrees of toleration. I myself can tolerate taking salicylate of soda daily, but if I give it to my wife it makes her ill and depresses her immediately. Some people can take it very much more than others, and without any perceptible effect perhaps.

3340. Would you allow salicylic acid to be used as a preservative at all?—I do not know very much about it, but I am rather in favour of salicylic acid myself, because it suits me personally. I am gouty, and it happens when I get gout in the stomach, and I take it in the morning before breakfast, it does not do me any harm, but rather good. So far, therefore, as my own personal experience is concerned I would prefer salicylate of soda or salicylic acid to boracic acid.

3341. Would you prefer to know whether you are taking it or not?—Certainly. That only shows that I can take it when other people cannot.

3342. (*Chairman.*) You do not know the amount of milk that was consumed by these seven persons, do you? —I am afraid I could not tell you that, but I could get it for you if you liked to have it. I will get the quantity, because the Lady Superior is a most intelligent woman, and I believe she took notes. I am sorry to say I have not got that information with me.

3343. It would be interesting to know?—May I send it to you?

3344. Yes. It implies a heavy dose of borax, does it not, to kill fowls?—I should think so. I said to the analyst: "You made a mistake in not getting out a quantitative analysis," and he said it was a very large percentage. That is all I could get. He said: "I was very busy, and you did not instruct me specifically"—and I am afraid I did not.

3345. How much blancmange did it take to kill the fowls?—This is what happened with regard to these fowls: They happened to be kept by a man next door; he rather scouted the idea of there being anything wrong with the milk. He did not seem to mind, so we did not mind. He did not seem to be frightened of his fowls, and so we let them have all they could eat. I could not tell you how much it was, but they consumed the remainder of the blancmange. The pullets were very voracious and they consumed a considerable quantity, and certainly the crops were discoloured by the chemical addition, whatever it was. The thing was not a made-up affair; it was an accidental affair; it was one of those cases in which the public are sometimes sufficiently kind to give us experimental examples of the injurious effects in these matters. It was one of the accidental affairs which occur in the ordinary investigation of outbreaks of disease. It was not made to order, and the facts can all be verified if you like. If you would like to have the analyst before you, if you would like to have the Lady Superior or the doctor, I am sure they would not have any objection to verify the evidence I have given as to the facts.

3346. I do not throw the slightest doubt on your statement of the facts: what I wish to ascertain is whether the amount of milk consumed by each of these persons who suffered from what you attribute to borax poisoning is known?—I will endeavour to get that for you and send it to you.

3347. (*Dr. Bulstrode.*) And also the amount consumed by those who were not attacked?—I will also endeavour to ascertain how much the cook and the Lady Superior took.

THIRTEENTH DAY.

Friday, 22nd December, 1899.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart, M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.

H. TIMBRELL BULSTRODE, Esq., M.D.

CHARLES J. HUDDART, Esq., *Secretary*.

Prof. A. W. Blyth.

22 Dec. 1899.

Professor A. WYNTER BLYTH, called; and Examined.

3348. (*Chairman.*) I believe you are a member of the Royal College of Surgeons, England?—Yes.

3349. And a Licentiate of the Society of Apothecaries? —Yes.

3350. You have been a public analyst for a considerable time, I think?—Yes, for a considerable time—pretty well since the passing of the first Act.

3351. I think you are prepared to tell the Committee something about the use of colouring matters in food?—Yes. I should like to say that when I was first appointed it was quite rare in my experience to find aniline colours in foods. There were simpler forms of colour, such as cochineal and the various hues that sugar could be made to assume by heat, and saffron, and so forth; but latterly, within the last eight or ten years, it is quite

Prof. A. W. Blyth.

22 Dec. 1899.

rare to find what may be called the natural colours in such matters as sweetmeats and other articles that are coloured—the rule is, and not the exception, to colour them with the so-called tar colours.

3352. Those, I suppose, weight for weight, would be more expensive than the natural colours?—No doubt they would be, weight for weight, but then their tinctorial power is so very great that I should say really the practical result is that they are much cheaper than natural colours.

3353. What are the substances in which you have chiefly found them?—I have found them in sweetmeats, in jams, and in jellies, and I have suspected them in butter. I have only found them in one sample of Burgundy wine; it is true I have not examined very many wines, but, still, those I have examined have always been naturally coloured. Some years ago I examined a sample of Burgundy wine which was certainly coloured with one of the aniline tar colours.

3354. Natural colours are very much used in wine, are they not?—The colour of the grape gives it a sufficiently nice colour I think without any artificial aid.

3355. Is not the poke-berry (*Phytolacea*) very much used in colouring red wines?—I do not think anything is used for colouring wines on any scale, at any rate in my experience. In those wines that I have examined I have separated the colouring matter—and it is comparatively easy to separate the colouring matter of wine—to identify it; it is like no other ordinary colouring matter.

3356. Have you found these aniline dyes in preserved vegetables?—Yes, in a few cases of very bright green vegetables, I have found them artificially coloured with some aniline dye.

3357. Have you found copper present in many samples?—In a great many samples I have found copper present, but not to any great extent. Of course, copper is a natural constituent of vegetables. I have quite recently examined a number of green vegetables, principally of French origin, for copper, and I have found copper in all, but I have not found it to any dangerous extent.

3358. Should you say that the presence of the aniline dye is frequently in such proportions as to be injurious to health?—I cannot say that in any one substance that I have ever examined the quantity of aniline dye, even presuming it is poisonous, would be enough to injure health; but then when you consider that so many things are coloured in this way it is a question whether the collective amount that a child, say, might take in the day might not have some injurious effect. Of course, the great majority of them are not poisonous. The only poisonous aniline dyes, according to Weyl, who has made a special research on aniline colours, are picric acid, dinitrokresol, Martius' yellow (which is said to be used in France and in Italy for colouring macaroni), Bismarck brown, Orange II., and metanil yellow. Those are the subjects of his research, and of course his research does not include all the aniline colours; I think, as far as I remember, it includes about 30 or 35. But his research embraces different classes of colours, and he has found these in fairly large doses poisonous to dogs and rabbits. If the Committee refer to his work they will see that he rather suggests that these particular colours should be prohibited by law—that is, of course, in Germany, as he is a German writer.

3359. Are you aware of any steps being taken by Continental legislatures to regulate the use of colouring matters?—Yes. I believe in Germany there are certain colouring matters which are prohibited, but I speak from memory. I think picric acid is one of them.

3360. Do you think it would be possible in this country to schedule injurious colours as distinguished from those which are harmless?—I not only think it possible, but I think it ought to be done, because dinitrokresol is without doubt used, and there is a case on record in French literature of a person who took something like 3½ grammes under the name of "Saffron substitute" of dinitrokresol, and the case was fatal. Of course, 3½ grammes in grains is a very much larger dose than could be taken in coloured foods, but still if it was fatal in a dose even so large as 3½ grammes I should say that very small quantities might injure a person's health; 3½ grammes, counting about 15 grains to the gramme, would be something like 50 grains.

3361. Such prohibition, to be effective, should apply to foreign as well as home produce, should it not?—Naturally so, because a great many things we get from abroad coloured.

3362. You have mentioned also that Martius' yellow is used in colouring macaroni?—Yes, I think so.

3363. It must be present in very small quantities?—Very small.

3364. I suppose it is possible to distinguish its presence by analysis?—Certainly. When things are used in very small quantities, it is only a question of operating upon a very large amount of material. Speaking as a public analyst, I must say with regard to looking for colouring matters and identifying colouring matters, the rule is that one gets such a small quantity of the sample that it is often very difficult to identify a particular colouring matter. You can only get the general idea that it belongs to the aniline class or something of that kind. But still if the legislature prohibited definite colouring matters the practice no doubt would be altered, and those coloured substances which were suspected of being dyed with the prohibited colours would be bought in very much larger quantities and divided and sent to the analyst in such a quantity that he would have an opportunity then of separating it in a weighable form.

3365. Have you had any opportunity of examining the colouring matters used in dairy produce?—I have never separated any colouring matter from dairy produce.

3366. A great variety of materials, patent mixtures, seem to be sold as a substitute for the old annatto which was used?—Yes, that is so; but I have not had an opportunity of examining into it; as I have stated, I have suspected artificial colouring matters other than the usual colouring matters in butter, but I have not separated them.

3367. (*Professor Thorpe.*) You know that now schemes of analysis have been drawn up by which it is fairly readily possible to detect the presence of almost any aniline dye upon a dyed fabric?—Yes, that is so.

3368. Now, the amount of dye upon any ordinary dyed fabric is relatively very small, is it not?—Relatively to the fibre, certainly.

3369. Therefore, analytically speaking, there ought not to be greater difficulty in searching, say, upon a sweetmeat for the presence of a specific dye than there would be upon a fabric?—Certainly not. It is only a question of quantity. But you know the quantity of sweetmeats that I usually have is something like an ounce; they buy from 3 to 4 ounces, and send me an ounce. Then those sweets are often mixed, they are not of one colour; they are red and blue, and white, and so the amount of sweets that I should have to examine would be perhaps a third of an ounce of a red-coloured sweet, say, and as the colouring matter is only on the outside of the sweetmeat it is, of course, very difficult to be absolutely certain to identify the colour of that particular sweetmeat, except with certain sweetmeats. For instance, nearly all the red sweetmeats are coloured now with rhodamine, or a colour of that type, and as that has very distinctive spectra, it is a colouring matter that it is very easy to detect.

3370. (*Chairman.*) Is rhodamine a noxious substance?—As far as I know no experiments have ever been made upon rhodamine, but I should say it was not a noxious substance, because to my knowledge it has been used for so long, and I have never heard or seen anybody that was made ill by it; besides, I have taken it myself in sweetmeats, and have not suffered in any way. So I should not think it was a noxious substance.

3371. (*Professor Thorpe.*) The object of my question, of course, was to elicit from you that there would be very little practical difficulty in putting in force prohibition and detecting the breach of it in the case of these aniline dyes?—I think very little indeed, and more especially if a particular dye was once scheduled; then analysts throughout the country would turn their special attention to practically studying the best tests, and the best method of separating that particular substance; that is always the case.

3372. You are aware, perhaps, that in large dyeing concerns, where it is often necessary to dye fabrics of a particular colour, there is used a scheme in principle very like the ordinary method of qualitative analysis?—Quite so.

3373. Whereby to begin with the colouring matter is placed in certain groups just as in ordinary qualitative analyses, and then specific tests are applied when the group is ascertained?—Quite so

Prof. A. W. Blyth.

22 Dec. 1899.

3374. You are aware that that is the practice?—Yes, that is so—by exclusion.

3375. That would be equally applicable to the detection of colouring matter in this way?—Certainly.

3376. You told us just now that copper is a natural constituent of vegetables?—Yes, it is so.

3377. What vegetables have you found it in?—I have found it in peas, I have found it in flour, in bread, and I have found it in cigar ash, that is, in tobacco. It apparently is present in all tobacco, and I do not think it can have been added to the tobacco. I have also found it in the ash of the lime tree. I happened for a particular purpose to be examining the ash of the lime tree, and I found it in that. Other people, if I remember right, have found it in lots of other substances. I am only speaking of my personal experience.

3378. Now, this is a little important, so perhaps I may take you rather minutely on this point. May I ask you precisely how you proceeded when you searched for the presence of copper in these things that you have mentioned?—I searched for it in the ash. I precipitated it with hydrogen sulphide in the first instance in acid solution, and then I obtained it ultimately as a film on a platinum dish by the electric currrnt.

3379. By electrolysis?—Yes.

3380. In the case of peas, may I ask you particularly how your proceeded. You took a quantity of peas, and you incinerated them, I suppose?—Yes, I incinerated them.

3381. In what?—On a platinum dish.

3382. In what way—over a lamp?—Over a Bunsen burner.

3383. In the ordinary way?—Yes, in the ordinary way.

3384. Did you incinerate all the other substances that you have mentioned over a Bunsen burner in exactly the same way?—Yes, I burnt them to an ash.

3385. Over the ordinary Bunsen burner?—Yes.

3386. Are you aware that it has been shown that when any substance is incinerated over the ordinary Bunsen burner, no matter what it is, you will find copper in the ash of it?—I am not aware of it. If it is so, I am surprised; but I should rather doubt it. Presuming copper is somewhat volatilizable, as one knows it is, for if you put a copper wire in a Bunsen flame you get a green colour, so we know it is volatilizable to a certain extent. I should think it almost unlikely that the volatilizable copper would rise up above the dish, and then go into the dish—I should think so, but, of course, I may be wrong.

3387. You have never heard of some comparative experiments which were made as the result of a paper published by a fairly well known French chemist, which appeared in the "Annales de Chimie," in which this gentleman drew attention to the widespread occurrence of copper. When his method of analysis was enquired into it was shown to be precisely that which you have indicated, but when in the ordinary Bunsen burner the tube was replaced by a glass tube those substances which had given the indication of copper no longer yielded it; do you know of that?—Was that Boussingault?

3388. No, it was not Boussingault; but do you know that circumstance?—No.

3389. You never heard of that circumstance?—No, I never did.

3390. Perhaps you will take it from me that it was so? —Yes.

3391. That, at all events, knocked the bottom out of the contention in the French experiments that copper was such a widespread ingredient; if that is the fact would that in any way modify your conclusions as to the occurrence of copper in peas and the other substances that you have mentioned?—Naturally; but years ago I operated in a different manner. I precipitated them direct from the pea by galvanic current, and I still found copper, so I think that there is copper naturally in peas.

3392. Has anybody, do you know, corroborated that statement of yours; have you heard that it has been confirmed?—In that way?

3393. Or in any way?—No.

3394. You have not heard that it has been confirmed that copper is a natural constituent of peas?—I believed that it was generally accepted that it was, and also in flour.

3395. You do not call to mind any experiments which directly negative that fact?—No, I do not.

3396. (*Dr. Bulstrode.*) Could you give me the reference to that case of dinitrokresol poisoning? Perhaps you have not it here?—It is a case recorded by Dr. Weyl.

3397. Is it in your book?—No, it is not in my book; it is in this pamphlet. (*Handing in same.*)

3398. Do you think it is possible by any direct evidence which can be obtained to determine this question as to the harmfulness of dyes and colouring matters?—I should think that by experiments on young animals carried on for a long time you would get some very useful information. I think that in the book of Dr. Weyl to which I have referred the error is that he experimented with very considerable doses on dogs and so on, his object being apparently to obtain what would be called coarse symptoms of poisoning; whereas the object I take it that the Committee have in view is to obtain evidence on the minor derangements of health that may be produced by either colouring matters or preservatives. It is quite obvious you do not get so much information for that purpose from what may be called coarse poisoning, because if these matters do any harm at all they do it in the form of producing indigestion, and the minor sort of ailments. It is a matter of common knowledge that nobody is poisoned by any common article of food at the present day, however it is treated, whether it is very thoroughly preserved by antiseptics or very much dyed by artificial colouring matters.

3399. You know probably that in Belgium colouring matters have been arranged into those which are harmful and those which are regarded as harmless?—Yes.

3400. That is the schedule. (*Showing same to witness.*) You will see the type of thing at once?—Yes, I do.

3401. Do you know anything as to the history of that—whether that has been based upon general principles or upon any experimental results?—I think if I remember right that fuchsine is classed among the poisonous colouring matters here; is that so?

3402. I think it is?—I believe the history of that is, that in the earlier days of the manufacture of the aniline dyes arsenic was very much used, and that was replaced afterwards by other substances which were volatile, such as nitro-benzol, and so on. It is, I think, the general opinion now that the bad character which fuchsine had was really altogether wrong, and was given it because at that time dyes were contaminated with arsenic, and there were a few cases of apparent considerable injury to health from small doses of some of those dyes. The symptoms and everything coincided with arsenical poisoning, and in a few cases when the dye which produced the symptoms was examined it was found to be contaminated with arsenic.

3403. May I just read you this, which I think rather bears you out?—As regards Austro-Hungary a decree of May 1st, 1866, forbids the use in food of any colouring matter which contains metals (iron excepted), gamboge and picric acid or aniline. . . . Aniline colours formerly contained arsenic, but as its presence has now been obviated a decree of September 19th, 1895, permits the use of a large number of aniline dyes for the colouring of sweetmeats, liqueurs, etc.; that is what you are referring to, is it not?—Yes, that is what I was referring to.

3404. Do you think some such arrangement as is set out there, and as apparently obtains in Austro-Hungary, would meet the case in this country?—I think it would, and I think it would be very valuable.

3405. You see no great difficulty in connection with the matter?—None whatever.

3406. At any rate, if there were some provisional classification?—Yes, for, of course, all those things ought to be sufficiently elastic, so that they could be added to or eliminated. If a particular dye that you put in a poison schedule was found to be after all harmless—if subsequent experience showed that it was—it would be right to have some machinery to be able to remove it; and as new colours are constantly coming into use it might be found after the passing of the particular Act having this schedule, that some new dye was really injurious. Therefore there ought to be machinery so that the list could be added to or altered.

3407. Have you any suggestions to make with regard to such machinery as you were just speaking of?—I should have thought that it would be comparatively easy for either the Local Government Board or the Board of Agriculture, or some central authority, to have the power to alter a schedule of the kind from time to time by order.

3408. Do you think a Standing Board of some sort, or a Standing Committee, would meet the case?—Certainly.

Prof. A. W. Blyth.

22 Dec. 1899.

3409. With regard both to preservatives and to colouring matters?—Certainly.

3410. You are aware probably of a recommendation made by the Select Committee on Food Products Adulteration in their Report of 1896; they say: "Your Committee, however, are disposed to think that it would be preferable to avoid the creation of an independent authority for the purpose referred to, and would recommend that the Court of Reference"—which they suggested—"should take the form of a Standing Departmental Committee appointed by the Board of Trade"?—That would be very useful, of course; I think all analysts agree that it would be very useful.

3411. I infer that you indicate that this question must be decided rather upon general principles than upon specific evidence; I mean general principles as to what we know as regards the poisonous effect of certain metals, rather than upon our being able to obtain anything like specific evidence?—I do not see how you can obtain specific evidence, because it is obvious that you cannot experiment upon human beings, unless you can have voluntary experiments made; but even then you could not experiment on a sufficiently large scale. I certainly think it will have to be decided on general principles.

3412. Do you think that experiments made upon young animals would afford a fair inference of what might be held to take place in the human economy?—I think so, if they were long enough continued, and if they were done by more than one individual; physiological experiments done by one individual are so often very unsatisfactory, because one finds that some other person of equal standing does the same experiments somewhere else, and gets quite different results. I think if experiments on young animals were done by two or three persons of eminence, and if the results agreed, they would be extremely useful indeed.

3413. Can you tell the Committee what colouring matters are used in wine within your knowledge?—In my knowledge I have not found any colouring matters used in wine.

3414. I thought you mentioned Burgundy?—In the case of that particular Burgundy it was an aniline colour; I should not like to say what it was, but it seemed to me like fuchsine.

3415. Could you give us an idea of how much there was?—I cannot tell you how much there was.

3416. With regard to liqueurs, what are the colouring matters used in them?—I have not examined any liqueurs personally.

3417. You say that occasionally salts of copper, picric acid, and impure aniline dyes are used?—Yes.

3418. But you have had no personal experience?—No. I have had no personal experience of that.

3419. In reference to beers, have you had any experiments?—I have not found any colouring matters in beer except those that are naturally from malt and hops.

3420. You speak in your synopsis as to the conceivability that a sufficient amount of colouring matter might be taken collectively into the system to disturb nutrition, to produce some effect on the central nervous system, or to cause derangement of the digestive functions; have you any special poisons in view there?—Apparently from Weyl's experiments dinitrokresol is poisonous in fairly small quantities. I should think such a substance as that would produce derangement of the digestive organs of young children.

3421. With regard to copper in peas; what would you suggest—do you think control desirable?—I think that if sufficient amount of copper is present, over and above that which will combine with the colouring matter of the pea, it would be injurious, or might be injurious. There is, however, a certain amount of copper that will combine with the chlorophyll, the colouring matter of the pea, and that amount I do not believe would be injurious.

3422. Could you give an amount expressed in sulphate of copper per lb. of peas?—I believe I have in my book on foods worked that out; but it is not in my mind at the present moment.

3423. Do you know what amounts have been found in peas?—Yes, I do.

3424. Could you tell the Committee that?—It has been expressed in grains per lb. As far as I remember, something like from 4 to 5 grains to the lb., and above, have been found; but, of course, I do not know how far, if Professor Thorpe's idea is correct, the copper was derived from the Bunsen burner.

3425. Do you know that in one case as much as twenty-six grains of sulphate of copper were found in a pound of peas?—I dare say it is so, but I do not remember the case.

3426. Would you think five grains of sulphate of copper too much for safety in a pound of peas?—I do not think it would do any injury; I do not think you would get any physiological result from five grains in a pound of peas.

3427. Owing to the fact of its being in combination?—Part of it would be in combination with the chlorophyll in an insoluble form.

3428. You do not think that it becomes soluble in the gastric juice, or in the economy?—I do not think it does; I think it would be mainly excreted with the excreta.

3429. If it did become soluble, would that alter your view; I mean, assuming that it were soluble or became soluble in the human economy, would you still think that five grains per pound was not too much?—I really could not give evidence that five grains per pound would injure health; that is all I can say.

3430. You know the Pharmacopœial dose of sulphate of copper?—It is from one to 10 grains, or something of that kind, is it not?

3431. I think it is from half to one grain as an astringent—somewhere thereabouts—and 10 grains as an emetic dose?—Quite so. It is very wide, up to 10 grains; and people have taken more than that without injury.

3432. Would you suggest its limitation, briefly put?—That is, copper artificially added?

3433. Yes?—I think there ought to be some limitation to it; but I think that five grains in a pound would not injure health.

3434. (*Chairman.*) On the general question, do you think there is any sufficient reason to justify the use of a strong poison, merely to alter the colour and not the quality of the food?—I do not. I think that it is certainly wrong to alter the colour by the use of strong poison, simply to make things attractive.

3435. Would you see any objection to imposing upon the vendor the duty of making a declaration of the presence of such colouring matter?—That, I think, should always be done; I quite agree with that. Then I do not see any harm even in the presence of large quantities—that is to say, if the purchaser is apprised both of the substance used and of the quantity, because he then gets what he asks for.

3436. There would be a difficulty, would there not, in specifying the exact quantity?—Of copper, say?

3437. Yes; we have had it in evidence that copper does not mix very readily?—No, it does not; there would be a difficulty.

3438. Now, turning to the subject of antiseptics, you have given a good deal of attention to them, I believe?—Yes.

3439. Can you give the Committee some of your experience with regard to them?—The only common antiseptics that are used now are boracic acid, borax, salicylic acid, and formaldehyde. In hot weather a great number of the samples of milk that I get are dosed with borax or boracic acid, but not in the winter time; in the winter time the number of cases of boracic acid in milk become small. I have certified to one in the last three days, and the summons is returnable in about a week, in which the milk contained an amount of boracic acid equivalent to 80 grains of borax to the pint; but it is quite rare at this time of the year to find the milk so heavily boraxed as that in my experience—quite rare.

3440. And such a proportion as that would be rare at any season, would it not?—I have found it so high as that in the summer months from time to time; still, it is high.

3441. Were you able to trace the system under which that condition was made: was it done by one hand, or by the successive hands through which the milk had passed?—That I cannot say. Of course, it may be so.

3442. What was the immediate source of supply to you?—An ordinary sample bought in Marylebone by one of the inspectors, who divided it, as usual, under the Act. It is not a watered milk. Milks that are dosed with borax very often are watered as well; it was deficient in fat and rather heavily loaded with boracic acid.

3443. Is that owing to the mixture of boracic acid with water before putting it into the milk?—When they are watered as well? Probably it may be.

3444. (*Professor Thorpe.*) In this particular case might it not have been an admixture of skim milk and fresh milk?—Most likely.

Prof. A. W. Blyth.

22 Dec. 1899.

3445. And the skim milk might have been preserved already with boracic acid?—Yes, very likely.

3446. Possibly, the fresh milk itself containing boracic?—Yes, very likely.

3447. (*Chairman.*) Do you approve of the practice of treating, unknown to the consumer, an almost universal article of food with a drug?—I do not approve of it; but at the same time I cannot say that it would be easy for the Legislature to prohibit it altogether. Take London, for instance; the greatest bulk of the milk comes from the country, and in the height of the summer I should imagine that quite a third of the milk supply would be spoilt before it reached the metropolis, or when it reached the metropolis, unless some preservative was used.

3448. That is under the present system of organisation?—Yes; if you can devise some method of very rapidly bringing the milk from the cow to the actual consumer, then no preservative would be necessary; but, as far as I understand the milk trade, I think you can hardly bring the country milk from the cow to the consumer in less than 24 hours. That is in regard to the great bulk of the milk reaching the actual consumer.

3449. Have you taken into account the effect of pasteurisation?—Pasteurisation, of course, would preserve the milk, but whether that can be done on a sufficiently large scale I do not know. I have examined lots of samples of pasteurised milk months old, but they were preserved in bottles or some hermetically sealed vessel.

3450. Is that not a question of organisation?—Yes, it may be so.

3451. You are aware, perhaps, that it is the system adopted in some of the Continental capitals?—I did not know that the whole of the milk was pasteurised in any place; I mean to say the milk that the ordinary people drink. It must increase the price I should think tremendously.

3452. At Copenhagen I think the whole of it is pasteurised, and distributed in bottles?—Indeed, that is very interesting, but of course Copenhagen is a very small place in comparison with our metropolis with its five millions of inhabitants.

3453. True, but of course, as I suggest, it is a question of organisation at the different centres?—Yes.

3454. How old is the practice of using borax in milk?—I really cannot say, I should think that it is many years old; so far as I can remember I think it has been found from time to time in milk.

3455. Do you know to the contrary, do you consider that twenty years ago it was a common practice to boracise the milk forwarded to large towns?—I never found it twenty years ago, but then I was in Devonshire, and the milk I had to analyse then was always country milk, and nothing was ever done to that, except watering and skimming.

3456. Are you aware that in the present time a large quantity of the milk that comes to London is not treated with preservatives?—Certainly; a very large quantity.

3457. What I understood to be the difficulty you perceive would be to convey the undoctored milk to the retail dealers in the poorer parts of London?—That is so—to the consumers.

3458. In this case do you think there would be any advantage in a declaration?—Certainly, I think in all cases, that if any antiseptic is added to milk the buyer should be in some way notified. You ought to be able to buy milk if you wish it without any antiseptic in it, absolutely free from any antiseptic. It is rather a serious thing that a person with young children feeding them on milk, when he asks for milk cannot get it without having some antiseptic in it.

3459. Would not such a declaration serve as a safeguard against the repeated application of borax or other preservative?—I think it would.

3460. The second preservative you mention is salicylic acid; have you found that frequently in food substances?—I have found it very rarely of late years, but I have found it in various temperance drinks apparently in order to arrest fermentation. Indeed that is evidently the object with which it has been added, to arrest alcoholic fermentation, so that the particular temperance drink may be almost free from alcohol.

3461. And the third preservative that you mention is formaldehyde?—Yes, that is used, but it is not used to anything like the extent of borax.

3462. Have you any preference for one of these preservatives over another?—I think formalin would be better than boracic acid; at the same time I am rather shaken by Dr. Annett's experiments. I think you have had Dr. Annett before you; he has made some experiments with formaldehyde and borax on young animals, and has found a considerable decrease of weight, and so on.

3463. Formaldehyde is a much stronger agent than borax, is it not?—It is a very much stronger antiseptic.

3464. (*Dr. Bulstrode.*) What is the adult dose of boracic acid?—I am not in practice now, and have not been for a great many years, but when I was in practice I used to constantly prescribe borax in honey for aphthous mouth, and so on; the solid borax was rubbed on the infant's lips, on the tongue, and so on. I should think that in that way the infant might take from 10 to 15 or 20 grains of borax in the course of the twenty-four hours, and it did not apparently have any effect upon it.

3465. Do you know that the adult dose in the Pharmacopœia is 5 to 15 grains?—That I have seen, but, as I say, when I was in practice something like twenty-five years ago, I have given borax in that way to infants, with apparently no particular injury.

3466. But the adult dose being 5 to 15 grains, that, of course, would be much in excess of the proper dose for a child?—Quite so, but I say that with this solid borax mixed with honey the infant must have taken, or had an opportunity of taking, a large quantity, in the course of twenty-four hours—not a single dose.

3467. From these investigations of yours it appears that at the present time a child taking, say, three pints of milk or two pints of milk a day might take 160 grains of boracic acid a day?—I should think that would be very injurious to the child.

3468. Do you not think on general medical principles the Pharmacopœial dose being, as I say, 5 to 15 grains for an adult, that something should be done to control and limit this?—Certainly. Although I have not seen any ill-effects from boracic acid myself. I yet think the evidence is quite sufficient with regard to infants to say that it is injurious in certain doses—in fairly large doses, or even in small doses continued for a long period of time.

3469. You know that many cases have been recorded of apparently the cumulative effect of boracic acid in adult patients who had been treated for cystitis?—Yes, I know that, although it is rather in opposition to some experiments by Liebrich, who has written a monograph recently upon the effects of boracic acid. He has shown that there is no accumulation in the system, or at any rate he believes that he has shown it, his conclusion being that it is all separated fairly rapidly.

3470. In a case I have before me I find that the borax was discovered in the urine forty-one days after the last dose, and in another case it was found fifty-three days after the cessation of the drug?—Of course that looks like accumulation.

3471. However, whether it be cumulative, or whether it be not, there is evidence to show that the continued administration of doses to adults, in quantities far less than we have been discussing here, does tend at times to produce injurious results?—Yes.

3472. You recognise that?—I know myself that if I take boraxed cream I generally get indigestion. I do not know—of course I may be wrong, but I ascribe the indigestion to the boraxed cream; on the other hand, other people take boraxed cream, and they do not appear to suffer.

3473. Would you think that it is desirable that in order that the medical man called in to treat you might not give you more boracic acid, he should know whether or not you are taking it with your food?—Certainly.

3474. Do you think that the labelling of food as to the fact that it contains preservatives would cover the whole difficulty?—I see a practical difficulty with regard to labelling in the case of the milk supply. When you order a particular dairyman to supply you with milk, the milk comes round early in the morning, the cans are hung on the palings, or stuck down by the door, and so on, and you can hardly expect every particular can to be labelled. I should have thought that in those cases a general declaration of the vendor that he is supplying milk with preservatives, say, during the hot weather, would be sufficient, without a special label on each can.

3475. That of course is a detail?—Yes, it is a detail.

Prof. A. W. Blyth.

22 Dec. 1899.

3476. Do you go so far as to think that the use of preservatives in milk is necessary?—I certainly think that in the hot weather you would not be able to supply the Metropolis, under the present conditions, with milk, unless they are allowed to use a certain quantity of preservatives, so as to keep the milk for, say, twenty-four hours.

3477. Do you think that in our large towns there would be great difficulty in supplying milk during hot weather without the use of preservatives?—I do.

3478. Would you take Birmingham, a town with a population of half a million, as a fair instance of a large town?—Yes.

3479. We have had it in evidence from Dr. Alfred Hill in regard to the milk supplied to Birmingham, a town with a population as I say of over half a million now, that only 9 per cent. of the samples of milk contained either boracic acid or formaldehyde, or any other preservative; if the inference from Dr. Alfred Hill's analysis is true, does that alter your opinion as to what is actually possible?—No, I do not think it does, because I think that it is very important to be able to get milk from considerable distances. I know that when I was in Devonshire, thousands of gallons were thrown away from remote places because of the difficulty of conveying the milk to a market where it could be sold.

3480. Do you know that the Aylesbury Dairy Company, which takes its supply from long distances outside of London, is said to carry on its trade entirely without the use of preservatives?—Yes, I know it is said to carry it on, and I daresay they do.

3481. If that is a fact, would that not point to the possibility of doing it?—With regard to the possibility of doing it you have got to consider transit, and the means of transit vary in different localities. Of course it is theoretically possible to get a gallon of milk from almost any part of the British Islands to London within, say, twelve or fourteen hours, but in practice that is not so. There are various forms of delay and various amounts of delay on different lines of communication. Of course the Aylesbury Dairy Company may be on one of the main lines on which there is an excellent service, and they may have made special arrangements with the railway company, and so they may get their milk rapidly, and in that case it is not necessary for them to use preservatives. But if you get a dairy farm on some branch line, and you cannot get your milk to London within a certain time, I apprehend then there must be some method of preserving it or else it will be spoilt.

Mr. R. Bannister.

Mr. RICHARD BANNISTER, called; and Examined.

3482. (*Chairman.*) You are a Fellow of the Institute of Chemistry and a Fellow of the Chemical Society, are you not?—I am.

3483. You were lately Deputy-Principal of the Inland Revenue Branch of the Government Laboratory?—Yes, I was for about 23 years.

3484. You are prepared to tell the Committee something about the use of preservatives; I may tell you that we have had a great deal of evidence upon the nature of the provision trade with Ireland and foreign countries, and we are thoroughly convinced of the change in the public taste that requires a mild-cured article instead of a salt one, so that we need not trouble you to repeat much on that score; but we should be very glad to hear any statement that you are prepared to make?—The first point that appears in my notes is the use of borax in preserving bacon after it has been cured with salt and saltpetre.

3485. That bacon is packed in dry borax for importation?—Yes, for importation into this country, and then for getting it finished for the English market after it arrives in this country. It generally comes over here green, then it is washed and dried and smoked. This borax is found to be very useful in getting bacon in proper condition for the purpose of receiving the smoking, so that it has a nice appearance when presented to the public, and at the same time it is a mild-cured bacon instead of being very salt, as it is if it is prepared with salt and saltpetre alone.

3486. I suppose as a matter of fact mild-cured bacon could be brought from abroad in other ways?—Well, it is not brought from abroad in other ways.

3487. Fresh meat is brought in large quantities from abroad?—That is brought in refrigerators, but that does not apply to bacon.

3488. It does not apply to bacon, but there is no reason why it should not apply to bacon?—I think it would be very inconvenient for it to apply to bacon, because, of course, there is a very great deal of expense incurred in connection with a refrigerator, and very little expense incurred in packing bacon in boxes and then importing it in that way.

3489. If it were proved that the use of borax was injurious to the consumer it would be quite possible to carry on the trade in the same way that the fresh meat trade is carried on, would it not?—It must be at a very greatly increased price.

3490. Why?—Simply because if you use refrigerators for the purpose of bringing over bacon you cannot bring that over at the same price as if you were to bring it over in boxes where it can be packed in borax.

3491. Is it not the case that fresh meat comes cheaply to this country?—It comes very cheaply comparatively; but if bacon had to be brought over in the same way it would be at a very great deal greater expense than that at which it is brought over at the present time.

3492. Have you considered the question?—Certainly.

3493. Have you made any calculations about the additions to the price of bacon?—No, I have not made calculations, because I had not the freight data at my disposal.

3494. It is just your general impression?—That is my impression, but as far as the deleterious effect of borax is concerned, from all the evidence that has been brought before us at the present time and extending over a series of years I have not heard of any case where the use of borax used in the way in which it is used in bacon has done anybody any harm.

3495. Have you anything further to say on the bacon trade?—Only that from my experience I have come to the conclusion that the use of borax in the preservation of bacon is a necessity.

3496. A necessity?—A necessity.

3497. How did you get on before. There was plenty of bacon used before borax was used?—Yes, but there is a change of fashion in the public taste for bacon. When you come to the bacon that was formerly used, the bacon that was cured by the local man and then was kept perhaps for six months or longer, that rancid bacon at the present time is scarcely considered a commercial article, and can only be sold locally.

3498. Yes, but "necessity" is a strong expression?—I used it advisedly.

3499. You say it would be impossible to carry on the bacon trade without the use of borax?—I said it would be impracticable.

3500. You said that borax was a necessity?—Yes, I do; I say so still—in the present condition of trade.

3501. But you have already admitted that bacon could be brought to this country in the same way that fresh meat is brought to this country?—I admit that bacon can be brought to this country in the same condition as fresh meat, but I do not admit that if bacon is brought to this country in the same condition as fresh meat, it would be exactly in the same condition as the bacon is at the present time, and be equally fit for the purpose of being finished for the English market, as it is now when it is brought over in boxes with borax.

3502. Then as to the butter trade; have you anything to tell us that we do not know already?—I do not know how far you have gone into the butter question.

3503. Do you consider preservatives a necessity in the butter trade?—I say yes, because the public taste now is so peculiar. The public taste at the present time is not satisfied with salt as a preservative. There is a very large quantity of butter that comes to this country that does not contain any salt at all.

3504. Are you aware that in one of the largest butter-producing countries in Europe the use of preservatives is prohibited altogether?—Except salt, but of course Danish butter cannot compete with the fresh butter of Normandy; you cannot take it in the same way.

3505. Can you tell us the comparative price at the pre-

Mr. R. Bannister

22 Dec. 1899.

sent time of Normandy and Danish butter?—The comparative price when it is bought by the hundredweight is that the Danish butter would be about 1s. and a fraction of a penny per lb., and the Normandy butter that I am speaking of at the present time would be about 1s. 3d. or 1s. 3½d.

3506. What is the percentage of salt in Danish butter?—It varies, but I should say about 2 per cent.

3507. (*Professor Thorpe.*) Is that an average?—No, it varies considerably; there is some a little less than that.

3508. What is the average?—I cannot say, because we do not know the quantities of each class produced.

3509. (*Chairman.*) What is the finest quality of Danish butter?—It is under 2 per cent.

3510. Are you speaking from accurate knowledge?—From commercial knowledge.

3511. Are you prepared to say it is more than 1 per cent.?—There are different classes of Danish butter; there are some mild cured and some strong cured.

3512. I mentioned the best class of Danish butter; that is what I was asking you about?—The very best Danish butter would be under 2 per cent.

3513. Are you prepared to say that it is over 1 per cent. in the best class of Danish butter?—In the very best class I would say no, I should not be prepared to say it was over 1 per cent.; but, at the same time, the Danish butter is a tub butter, and the other butter—the roll butter that I am speaking of—is not a tub butter, but it is made up into rolls from the dairy and imported into this country in that way, in boxes containing 24lbs.

3514. Are you talking of Normandy factory butter?—I am talking of Normandy factory butter, which comes over here in very large quantities.

3515. Perhaps you could not tell us the relative amount of the imports of butter from Denmark and from Normandy?—No, I cannot; I have not got the returns. I thought that would be easily got from the Blue-books, so I did not give myself the trouble of getting it. The Danish butter compares more with the old Irish butter rather than with the Normandy roll.

3516. What do you call the old Irish butter?—There has been a difference in the manufacture of Irish butter. In days gone by they used to make Irish butter at certain seasons of the year, and then there was a long period when the Irish butter had to be kept before it was put on the market, and it had to be prepared with a large percentage of salt. But during the last few years in Ireland creameries and factories have been established, and there are one or two factories in the south of Ireland just in the same way as in Normandy, but that produce is quite different from the old Irish butter.

3517. I ask you again, What do you mean by old Irish butter?—I mean the old tub butter that used to be made.

3518. Heavily salted?—Heavily salted.

3519. Do you compare the present Danish butter with that?—The present Danish butter has been a substitute for that butter, and now the Irish people are working up to something like the same quality as the Danish butter, which they should have done long ago.

3520. Why do you compare the one with the other—simply because one is a substitute for the other?—I cannot think for an instant, as a commercial man, that Danish butter is a substitute for Normandy roll or factory-made butter; it is not.

3521. Is it not the case that the Danish butter, as we get it now, is a totally different substance from the old Irish butter?—Certainly, but there is some of the Irish butter that is equal or superior to Danish.

3522. (*Professor Thorpe.*) But that is not the old Irish butter?—Some of the old Irish butter was as good butter as ever was made, and was not heavily salted.

3523. I think we ought to be quite clear about this; the old Irish butter was a heavily salted butter?—That made for winter use, but there was butter made in Ireland in the summer months when there was plenty of grass—as good butter as ever was made in the world, and for quick consumption was not heavily salted.

3524. And that old Irish butter contained what everybody must regard as an abnormal amount of water in it?—No, it did not.

3525. Pardon me, the old Irish butter that, certainly, the Chairman has in his mind, is that type of butter, heavily salted, containing a large quantity of brine?—But some of the Irish butter does not contain a large quantity of water.

3526. No, but we are talking of the old Irish butter?—But all the old Irish butter did not contain a large quantity of water.

3527. What was generally known as old Irish butter did?—I do not say that, in exceptional cases, the old Irish butter did not.

3528. But the average quality of the old Irish butter was of that type—heavily salted butter?—I disagree with you there.

3529. We have had it in evidence, and so far I am only stating, or informing you, what we have been told?—Yes, I understand.

3530. (*Chairman.*) Was this old Irish butter, which you say was made in summer, salted?—It was slightly salted.

3531. To what extent?—One or two per cent.

3532. Your opinion is that boracic acid, or some such preservative, is a necessity in the butter trade also?—I do think so.

3533. What was it that put the Irish butter out of the market?—There were three or four reasons. The first reason was that Irish butter was not made during the whole year.

3534. I mean what country was it?—Denmark. In Denmark they are very careful to make the butter during the whole year, and they keep having new milch cows into their dairies, so that they can have a good butter during the whole year and that is the only way to keep a trade.

3535. Therefore it is your opinion that Danish producers without preservatives have driven the Irish producer out of the market?—Yes, for the present.

3536. Is there any reason, therefore, to believe that borax is a necessity to the Irish producer?—I do not say, in a particular class of butter, but then there is creamery butter, made in Ireland, and also factory butter, and it is necessary there the same as in Normandy.

3537. In creamery butter?—In creamery butter.

3538. Are you aware that in some of the largest creameries of this country no preservative is used in the butter whatever?—I am quite aware of it, but, at the same time, at certain seasons of the year I know as a fact from my own experience that if you get a creamery butter and have no preservative in it, and you have that butter in use for a week, it has gone off—it is not fit for consumption as fresh butter.

3539. But the fact remains that they do not use preservatives?—Many do.

3540. In face of that fact that many do not, do you still regard it as a necessity?—Before I can properly answer the question I want to know exactly how this butter was consumed, whether they had got the means of sending it into a large establishment where it was consumed very quickly, because in that case there would be no necessity for putting in borax or boracic acid. But if that butter had to be kept for any particular time, especially in hot weather, it would soon go off, get very hot, and be disagreeable, as a fresh butter.

3541. You admit, I take it, that it is not a universal necessity?—It is not in universal use for the particular kind of butter.

3542. That was not my question. I asked you if you admit that the preservative is not a universal necessity in creamery butter?—It is not under special conditions.

3543. That modifies your former answer that it was?—No, under special conditions, under special circumstances of consumption.

3544. Does the Normandy butter all contain a preservative?—I could not say that certainly.

3545. Does it, as a rule?—Either that or salt, because of course there are many different classes of Normandy butter, each being treated according to trade requirements.

3546. Turning now to milk, is it your opinion that a preservative is necessary in the milk trade?—That, I think, you will see from the précis of my evidence I have gone very carefully into. There are so many circumstances in connection with the distribution of milk in towns that it is a very difficult matter to come to any particular decision on it, because the milk trade has been

Mr. R. Bannister.

22 Dec. 1899.

so altered during the last fifteen or twenty years; the milk has now to be got from such very distant places that in the summer time very frequently new milk, so called, comes on to the table, even from the best places, in an acid condition, and in those circumstances, probably, if the borax would keep it from getting sour, it would not do so much harm as the sour milk, especially for children.

3547. Have you any knowledge as to the extent to which the preservative is used in London—is it universal in summer?—No.

3548. Could you give the Committee any idea of the proportion in the milk supply of London?—No, I cannot do that. It depends so very much upon whether the distributors of the milk have got the means of distributing it to what you may call a first-class neighbourhood, because then the milk is out of hand directly; but when we come into the poorer neighbourhoods, the method of distribution has to be very different.

3549. Would you see any objection to making it obligatory upon the vendor to notify the presence of a preservative?—I think that there is no objection to that course at all.

3550. (*Professor Thorpe.*) May I ask if you see any objection to also notifying the amount; would there be any difficulty in that, in your opinion?—There would be a difficulty there.

3551. I quite apprehend it, but perhaps you will tell the Committee why you think there will be a difficulty as to the amount?—In the first place, there will be a difficulty in getting the boric acid into solution—that is the first difficulty that you would have; in the next place, when we come to the estimation of the boric acid, there is a very great difficulty in properly estimating the percentage of it—it is a difficult thing to do. So in the circumstance I cannot very well see my way to suggest that the quantity should be declared. In the next place, taking the distributors——

3552. (*Chairman.*) You say that the quantitative analysis—the exact proportion—is difficult to determine?—In the case of boric acid, yes.

3553. Is the result apt to be misleading or uncertain?—Within certain limits. Dr. Thorpe will know very well that the estimation of boric acid is not an easy thing.

3554. (*Professor Thorpe.*) Still the qualitative detection is very simple?—Very simple.

3555. (*Chairman.*) I think I interrupted you just now?—Yes. Take the distributor himself, he does not produce the milk, but gets it from other sources, and very likely before that milk comes into the hands of the consumer it goes through perhaps four or five different hands, and in that way there would be a very great difficulty indeed in fixing the amount. Then milk is mixed again by the consumer.

3556. Might I ask if the effect of the declaration would, in your opinion, tend to limit the amount?—I think it would.

3557. Have you much experience of salicylic acid as a preservative?—I have had some experience of it.

3558. What are the substances you have chiefly found it in?—It is chiefly used in British wines and liquids that have to be presented to the public in a clear condition where you cannot naturally get a sufficient quantity of alcohol in the liquid for preservation, and you have to use another substance for the purpose of preserving it and keeping it bright. It has also been used pretty extensively in fruit pulp and the like of that to keep it from fermentation in bringing it over to this country for making into jam.

3559. Have cases been taken to the courts?—Yes, there have been two cases that I know. There was one case, if I remember rightly, at the Westminster Police-court, where it was present in some lager beer that was imported, and a conviction was obtained on account of the quantity present. Then there was another one at the same police-court; I think it was a case of orange wine manufactured by a person at Leith, but that case was dismissed on its merits. I have given the details of the case in the *précis* of my evidence.

3560. (*Professor Thorpe.*) Respecting the colouring matters in foods, what are your opinions as to the desirability or otherwise of colouring peas with copper? I notice that in your *précis* you dwell at some length on that, so perhaps you will state to the Committee what your view of the matter is?—Regarding the use of copper in peas, I can give you a case in point from a large commercial house that sells a considerable quantity of canned peas. There are two classes of peas mentioned in their price list; there is one class containing copper, and there is another class that are sold in their natural condition. I got from them a return covering the last year that the quantity sold of peas that were greened by copper was 92·2 per cent., and the natural peas (it was mentioned so on the label and in the price list) were 7·8 per cent. only. When we take into account the amount of copper that is required, and that in France, where they are great canners of peas, experiments have been made and conclusions have been arrived at that the quantity of copper required does no harm—I think it would be a hardship if it were prohibited in this country.

3561. What is the object of adding the copper to the peas?—For the purpose of giving them their natural colour.

3562. The colour of what?—Natural colour of green peas.

3563. That is to say, to give the peas which otherwise have not a natural colour what you call a natural colour?—Yes, exactly.

3564. In other words, to make the pea simulate something which it not actually is?—Allow me to answer that in another way, please, because in my opinion the question is not fairly put.

3565. Would you kindly answer the question. What is the object of adding the colour?—It is for the purpose of bringing it back again into its natural condition of colour.

3566. Its natural condition of colour?—The same colour as the pea has naturally.

3567. Not by the same means?—No, not by the same means; because copper is added, which is not in the original.

3568. In other words, it is to make the pea simulate something which it is not?—Yes, and it is just in the same way with many other things, as coloured butter, coloured cheese, and the like.

3569. Does it or does it not make the pea simulate something which it is not—it makes an old pea a new pea?—It is not an old pea. I beg your pardon; they do not tin old peas, but the best that can be grown.

3570. Then I will put it in another way—to make a pea which has gone off colour resemble the fresh bright green of a new pea?—Exactly, and what the public like, just in the same way as we colour butter.

3571. Is there not something in it of the essence of a fraud?—No.

3572. Not to make a thing appear that which it really is not?—In my mind there is not the slightest essence of fraud, and for this reason: you can only produce peas during a certain season of the year, and people will not have them uncoloured. If you go on board a passenger ship or if you go to a club house, I am bold to say that you will find these coloured peas will be on the table, either at the mess or at the club house, almost every day in the year, and yet there are only about three or four months in the year that you can get green peas.

3573. In that case I presume the vendor is taking advantage of the ignorance of the consumer?—He is not, in my opinion.

3574. Why? Is the consumer informed that he is eating a pea which has been coloured with copper?—I can state from my own experience that in the commencement of the working of the Food and Drugs Act of 1875—I think it was in 1876 or 1877—there was a case at the Marlborough Street Police-court of peas containing copper; the magistrate convicted from the evidence given, and I know for a fact that large establishments in the City of London at once went back to peas of the natural colour, but this only went on for a very short time. They said: "Our customers will not eat them, and we are compelled to go back again to those that are coloured." So they have them not for the purpose of deceiving their customers, but for the purpose of pleasing them in their food.

3575. (*Chairman.*) For the purpose of enticing them to buy?—Yes.

3576. (*Professor Thorpe.*) Did they take their buyers into their confidence and announce that the colour had been restored by the use of copper?—No, they did not, but it was well known in the trade that it was so.

3577. In the trade, yes?—And to the customer, too.

3578. No, there perhaps we may differ; I do not think it is known to the consumer, but it is perfectly well known to the trade?—And it is perfectly well known to the consumer.

3579. To certain consumers, but it is not generally known that peas are coloured with copper?—Take this illustration that I have here: Peas are sold in their natural colour and without any addition at all, and you get as the quantity that is taken in that condition 7·8 per cent.

3580. Is it on the other tins stated that they are artificially coloured with copper?—No.

3581. You state in your *précis* that the copper compound—you call it a copper albuminate—is not dissolved during the ordinary process of digestion; upon what authority is that statement made?—There are two statements that I have. One statement was made to me by Dr. Paul, who experimented on himself and examined the ejecta from himself, and there is another one that is given to me by a professor in South Yorkshire, who made a similar experiment.

3582. Do you know his name?—I am not at liberty to give his name; it was in connection with a pea case.

3583. Was this gentleman whom you have last mentioned a witness?—He was a witness.

3584. Did he give evidence to this effect?—No, it was on another point altogether that he gave evidence, but he made an exhaustive inquiry into the use and effects of copper in green peas.

3585. Then you are unable to tell us of more than one authority?—Only one authority—Dr. Paul.

3586. Do you know any *primâ facie* reason why the copper is not in any way attacked by the constituents of the gastric juice?—No, I do not; I am not a medical man, and I am unable to go into all the details of such work.

3587. But you are a chemist?—Yes.

3588. Very well; are there not some constituents in the gastric juice which you would assume would attack this copper compound?—That is the statement made by one class of experts and denied by others. Even supposing I go so far as this in connection with it—even if the copper were to go into solution—there are thousands of tins of coppered peas that are consumed during the year, and we have not had one case of harm being done, so that even supposing the whole of the copper were to go into solution, I cannot see from prolonged experience what harm it would do when present in peas. So, as far as that question is concerned, I do not think there is much in it when the consumption of these artificially greened peas is so large.

3589. Upon what authority is that statement made; how do you know that people have not suffered inconvenience by eating the coppered peas?—We have got no cases; we cannot find them anywhere recorded—I have read books for the purpose of seeing that—and the quantity of peas consumed containing copper being enormous, we should expect to find some authentic cases.

3590. I suppose copper is a poison?—Certainly, when taken in large quantities.

3591. Is it a cumulative poison?—I do not know.

3592. In consideration of the fact that there is a considerable amount of doubt, to say the least of it, as to the effect of eating peas artificially coloured with copper, do you not think that in the general interest it would be a desirable thing that the public should be notified that they are eating peas artificially coloured?—Yes, certainly. I think there is not the slightest objection to placing such notification on the tin, only there is this difficulty about it: Suppose you were to do that, and place the notification on the tin, you see, the person who eats the peas as a rule does not see the tin, because they are used in large establishments, and they are not used by the poor.

3593. Still, I suppose the greater number of peas are used in households—they are not merely used in restaurants and clubs and refreshment rooms, but they are also used in private households?—Yes, sometimes in private houses, but mostly in large establishments like clubs and hotels.

3594. Very frequently?—Yes, but I do not see the slightest objection to have something on the label to point out that they have been artificially coloured with copper.

Mr. R. Bannister.

22 Dec. 1899.

3595. It would add to the general knowledge that there ought to be on this matter by that notification?—Yes. I think at the present time in the State of Pennsylvania "Artificially Coloured" has to be stated on the label.

3596. And you would approve of that?—I cannot see any objection to it in any way.

3597. Do you see any objection to stating the amount of copper which has been used for artificially colouring the pea?—No, I do not think that there would be any great difficulty about that, because you cannot put in a large quantity of copper for the purpose of doing the work as it spoils the appearance and flavour of the peas.

3598. Even if you could, is that germane to the point?—What I mean to say is this—that, of course, in the manufacture, or rather, in the preparation of these peas, the work has to be very carefully done, because, in the first place the peas are put into a vessel where the temperature is raised considerably above the temperature of boiling water for the purpose of destroying germination, and that is the time really when the copper is put in. Then the pea after that is washed, so that there is no extra copper at all in the liquid, because it has all gone. Therefore, whatever copper there is, it is really in the body of the pea itself. In regard to the quantity that is really there, among the cases that I have seen—and I have gone carefully into the literature on the subject during the last few months—I do not know of any cases where there is more than about one part of metallic copper in 10,000 of peas. In the French Government reports of 1889 and 1896 one part in 7,700 is given as a fair average, and the Minister of the Interior concluded that there was no necessity to interdict the then process of greening, and so acted.

3599. You made use of the expression "in the body of the pea"; are you aware where the copper actually is in the pea?—When I say in the body of the pea I could not say, because I have not made the experiment, whether the copper is diffused through the pea or whether it exists more in one particular part of it.

3600. I thought perhaps your observations might have enabled you to say where the copper was exactly located, because of course in that case it might tend to be concentrated in that particular part to the exclusion of the other?—Yes. I think myself, from observations I have made, and from experiments too, that the copper is diffused pretty well throughout the whole of the mass of the peas; that is to say, you would not have the copper more in one particular part of the mass than in another, and for this reason—because in all samples of that kind it is so very important that the peas should be of a uniform colour, and if one portion of the peas took up a larger quantity of the copper than the other, the bulk would not be uniform, and therefore would not be what we may call a proper commercial article.

3601. The object of my question was this: We have had it in evidence from gentlemen who have given some attention to this question that the copper is associated with the chlorophyll of the pea?—Yes, that is the view held by some.

3602. Now, the chlorophyll of the pea is on the outer portion of it almost exclusively?—Yes.

3603. Therefore if that be the case the copper is rather located in the outer covering of the pea?—In the husk.

3604. Not in the body of the pea?—No, if only combined with chlorophyll it would not be uniform throughout.

3605. That would tend to its concentration?—It would.

3606. (*Dr. Bulstrode.*) What is supposed to be the physiological result of the administration of copper sulphate?—I have not gone into that question; that is rather apart from the subject of colouring peas with copper.

3607. You have not gone into that question?—No.

3608. Yet you state that the amount of copper administered is not likely to be harmful?—Exactly. I must take common observation as the ground of my statement, because I know that this large quantity of peas is sold, and on reading the medical records I cannot find any evidence at all that has come to my knowledge where it is stated distinctly that any damage which has been done to the eater has been caused by the copper that has been used in the peas that have been eaten.

3609. Do you disagree with this statement—this is in Dixon Mann's "Forensic Medicine and Toxicology"; he says here, "In green vegetables copper probably exists as an insoluble leguminate from which the metal is

Mr. R. Bannister.

22 Dec. 1899.

liberated and rendered soluble by the action of the gastric and pancreatic juices"; were you aware of that statement?—Yes, I have been aware of a statement of that kind, but it is only a probability of the writer's, not the result of experiment.

3610. But you do not agree with it?—I cannot agree with it. When a person makes an experiment which shows distinctly that it is so we can believe, but many things that are seen in books we cannot believe, as they are nothing more than quotations from other books, not experimental results.

3611. Do you know of any other experiments which tend to show that the copper is really soluble in the human economy?—No.

3612. We have had some experiments before us which tend to show that, but of course they are not published yet; how much copper do you think is a safe amount in a pound of peas?—About one part in 10,000—that would be about 2·9 grains of the commercial copper sulphate to the pound.

3613. Perhaps you do not know that copper sulphate is used as an astringent in doses under a grain?—It is.

3614. Do you think it is right that the public, who may not be in a condition to require the administration of an astringent, should have one indiscriminately administered to them?—The first question to be answered is—would the copper act in the peas exactly in the same way, because it is not sulphate of copper in the peas, the copper being combined with the colouring matter of the pea.

3615. You do not say it would not?—We cannot say that all the salts of copper act in the same way; in fact, we know they do not.

3616. Have you any evidence to show that it would not so act?—No, but I have got plenty of evidence to show that the people who eat these peas get no damage from eating them.

3617. Would you expect that you would observe the result of an astringent dose on the public; do you suppose it would be a matter of public notoriety? Suppose a patient had diarrhœa and he was given an astringent and the diarrhœa ceased, you would not necessarily know that, would you?—No.

3618. Have you any evidence pointing to the fact that sulphate of copper administered with peas does not produce the physiological result which it is stated to do in the British Pharmacopœia?—I think that is a question that is rather difficult to answer. I think I have just got the same right to ask this question—whether medical authorities have got any distinct evidence to prove that persons who have eaten these peas have suffered in the way stated.

3619. Would you think that a dose of ten grains of sulphate of copper in peas should be allowed per pound?—You never get ten grains of sulphate of copper in peas, because the copper is not there as a sulphate.

3620. It can be estimated as sulphate of copper?—Yes, it can be estimated as sulphate of copper, but it is not sulphate of copper in the peas.

3621. Do you think that an amount of copper which could be estimated at ten grains of sulphate of copper is safe?—But that is not, I think, quite a right way of putting it, because the copper in the pea is not there as a sulphate.

3622. Let me read you this—"The amount of copper varies in different specimens, from one grain per pound of peas upwards in one case to an enormous amount of copper equal to 26 grains of crystallised copper sulphate per pound of peas was detected"?—I do not believe that statement. I do not believe that copper equivalent to 26 grains could be there. I feel quite certain that that 26 should be 2·6. The decimal point is omitted.

3623. You see he refers to "the enormous amount," which 2·6 is not?—Yes. Can you tell me when the case was reported, because there was a case reported some time ago exactly in the same way, where the decimal point was wrong, and instead of being 26 it was 2·6?

3624. I think that mistake is hardly likely to be made here, because he refers to 2·8 and so forth as being a more or less reasonable amount?—Twenty-six is out of all calculation.

3625. You will find it in the "Sanitary Record" for 1897?—I feel certain it is 2·6.

3626. With regard to the introduction of butter preserved with boracic acid, do you see any reason why, if fresh meat can be brought into this country from abroad without the use of preservatives, butter should not also be so brought?—No, you can bring it here exactly in the same way, but when you come to fresh meat, if you keep that fresh meat for a while the butcher will dust it with borax for the purpose of keeping it dry. In the case of butter, you can bring it over to this country, it is true, but then you have to take into account also how long it will be before it goes into consumption, and any person who knows anything at all about butter distribution will tell you the same. I am telling you now—that when butter has been brought over in the refrigerator it will not bear the same treatment after it has been in the refrigerator as before, and when exposed to the air will rapidly deteriorate.

3627. It decomposes more readily?—It does.

3628. You said there had been a difficulty in estimating the amount of boric acid, because it is difficult to get boric acid in general solution; was that what I understood was the case?—That is so.

3629. Do you mean that it is difficult to be assured that the boric acid added is in uniform diffusion?—Exactly.

3630. (*Professor Thorpe.*) In milk?—In milk.

3631. (*Dr. Bulstrode.*) Do you see in that any argument against the indiscriminate use of boracic acid in milk?—As I think you will see, I have given you my reasons for coming to the conclusion that it is really a very debateable question about the use of boric acid in milk for children.

3632. Would you answer that point. Do you think, if your statement is true, that there is a difficulty, in diffusing the preservative—that you would be likely to get a larger amount of preservative in one part of the milk than in another?—You might do.

3633. Do you think that is an argument against the indiscriminate use of boracic acid in milk?—No, I do not think so.

3634. You do not think there would be danger of there being an overdose of boracic acid?—I beg your pardon, I did not understand your question—there would be. I will give you an illustration of it. If a man who is sending up a milk can from the country puts a quantity of boric acid into that milk can when it starts and that is not disturbed until it comes for distribution, there is very little doubt that that milk would not contain the same quantity of boric acid throughout it.

3635. Do you think that the fact of labelling the milk, "This milk contains boracic acid," would cover that risk?—No, it would not.

3636. How much boracic acid within your experience has been found in a pint of milk?—I think up to about 60 grains to the gallon.

3637. Would you be surprised to hear that the previous witness told us that he had found 80 grains of, I think he said, boracic acid in a pint of milk?—In a pint of milk?

3638. Yes?—The consumer would taste it, and the flavour would be objectionable.

3639. Would that be any reason, in your view, why if these preservatives were allowed to be used the amount should be stated?—Yes, I think so; in a case of that kind, if such a quantity as that is used, but I never heard of such a case before.

3640. If that statement is true, would you think that the danger is such that it counterbalances any trade requirement for the use of preservatives that there may be?—If the statement were true, I say it would; but you must take into account that this is an isolated case, and other people have not used such a quantity. It must be really an exceptional thing and not the rule, because that quantity of boric acid would be tasted quite easily by the consumer.

3641. Do you think the use of boracic acid in milk is a commercial necessity?—At certain seasons of the year.

3642. Do you think that the trade in milk of a place like Birmingham, with half-a-million people, could be carried on without the use of preservatives?—There would be very great difficulty in doing it. I will give you reasons for my opinion. A large quantity of that milk comes from a long distance. The first regulation that is laid down by these large milk distributors in a place like Birmingham, and the same applies to London, the very first condition is that when they get their milk, as they do, from good respectable people, they say the very first thing you must do is, you must put it through a refrigerator and reduce your temperature to about 65 degrees Fahrenheit. This last year during the summer many of the farmers have had no water for the purpose of using the refrigerator. That has been a great difficulty. As far as the milk in large towns is concerned, when it comes to the consumer, from my own experience—because I have tried it day after day through a very good milkman who has got a large dairy—I must say that during the hot weather every time that I tasted the milk it was slightly acid.

3643. Would your position be that Birmingham could not be supplied with milk were it not for the use of preservatives?—If it applies to the whole year, yes.

3644. Would you be surprised to hear that Dr. Alfred Hill, the public analyst of Birmingham, has told us that only 9 per cent. of the milk supplied to Birmingham contains preservatives?—Yes, I saw the statement was made.

3645. Now, if 91 per cent. of the milk of Birmingham can be supplied without preservatives, do you think the use of preservatives is such a serious commercial necessity as to overlay even the slight risk which there may be of the damage?—But the small number of samples that Dr. Hill examined did not properly represent the milk supply of Birmingham.

3646. That opens a wide question?—It does, it is true, but that should be considered in coming to a conclusion on such a statement.

3647. If the inference from Dr. Hill's investigations is true, do you agree with the questions I put to you?—Yes.

3648. You say at the present time hams and bacons are cured in England with a mixture of boracic acid or borax and salt and saltpetre?—Yes.

3649. And that it is said to be a necessity in the curing of mild-cured bacon that the quantity used is from one quarter of a pound to one pound per hundredweight?—Yes.

3650. Do you mean to one pound of the whole mixed preservative?—No, from one quarter of a pound to one pound per hundredweight of meat.

3651. The mixed?—The proportion refers to the meat, not to the mixed preservatives used.

3652. Is it made into a solution?—No, it is put on dry as salt and saltpetre are put on dry; it is rubbed in as a powder.

3653. They are all rubbed in as a powder?—Yes.

3654. You also say in your précis that the employment of decomposed milk increases the danger of sour milk diet to babies, and that together they form a fruitful source of disease and infantile mortality?—Yes.

3655. What is your basis for the statement that sour milk does form a fruitful source of disease and infantile mortality?—Because I have seen children who have been fed with the bottle, which is generally not kept clean, who have had diarrhœa, and they have wasted away.

3656. Did you ever hear it stated that a certain amount of the infantile diarrhœa of this country was due to the use of preservatives?—I have heard it stated, and I have not the slightest doubt it is so.

3657. You think it is so?—Yes, I do, because when you get children that do not have their mother's milk, and have to depend upon other milk, it may be in a slightly decomposed condition, and I think boric acid in milk in that condition (I have had some myself) must have a very bad effect on the children.

3658. Do you think the boric acid might be prejudicial to the children's health?—Yes, I do.

3659. You say in your précis that formalin is dangerous?—Yes.

3660. Why do you say that?—The reason is this: When you add formalin to milk it seems, as far as the curdy matter of the milk is concerned, to act directly on it, and changes its physical character, and, as formalin is a poison and is used as an antiseptic, I think it is very dangerous to have such a substance as that in milk.

Mr. R. Bannister.

22 Dec. 1899.

3661. (*Chairman.*) You have not told us anything about the presence of preservatives in beer?—Sulphurous acid in one form or another is chiefly used in beer as a preservative.

3662. In what sort of quantities?—In small quantities—every brewer who uses it has a quantity he works up to—not all the brewers, but the majority of brewers use it in certain proportions for the purpose of giving a particular character to their beer and keeping the beer of that special character. Sulphurous acid certainly keeps beer from going sour, and it is also used very largely in cleaning vessels in the brewery.

3663. Are there any other preservatives which are used?—Salicylic acid, I think, you have spoken about?

3664. Not in regard to beer, I think?—I do not think salicylic acid is used as a preservative of beer at all in this country; it has such a distinctive taste.

3665. Or of cider?—It may be in cider, because cider contains such a very small quantity of spirit that it will not keep without something being added as a preservative.

3666. (*Professor Thorpe.*) Is salicylic acid used in imported beer?—It was in a case of lager beer, but the quantity of imported beer is very small. As a rule, I should say salicylic acid is not used in imported beer, because a great deal of it is generally imported in bottles, which require no preservative.

3667. That will not contain, you think, salicylic acid?—No, I think it would not contain salicylic acid, and I do not think it would be necessary for it to contain salicylic acid, because it would keep itself under the pressure of the gas and when not exposed to the air.

3668. (*Chairman.*) In your evidence before the Beer Materials Committee you gave a long list of substances used in beer as preservatives?—I think you will find that that evidence, or, rather, that information, was got in this way: The information was given to the Chairman of that Committee by a gentleman who gave evidence on behalf of the agricultural interest, and then it was referred to the laboratory at Somerset House for the purpose of going over the books to see what these substances were, and when they were found. That extends over a period of something like about 30 or 40 years.

3669. You have not detected them?—No. It was only put in for the purpose of assisting the Committee, and I had to undertake it.

3670. Then, practically, sulphurous acid is the only substance which is in common use?—That is practically the substance which is in common use, because it does another thing to the beer—that is, it keeps it of a nice bright colour.

3671. Some of the lighter beers, the lager beer and so on, contain salicylic acid, do they not?—I have only one instance of that, where the case was tried at Westminster Police Court, as before stated.

3672. (*Professor Thorpe.*) You would not class sulphurous acid as an antiseptic in the same class as formalin, would you?—No, not at all.

3673. Not at all?—No, it keeps changing into a sulphate, a natural constituent of beer.

3674. I mean to say, it is not so dangerous?—No.

3675. (*Chairman.*) I would just like to ask you, in conclusion, as a general rule, do you think that the trade, and especially the dairy trade, would be seriously interfered with by the prohibition of the use of certain preservatives?—I do.

3676. Also the provision trade generally?—It would.

3677. But you would see no objection, I understand, to making it obligatory to notify the presence of these preservatives?—I see no objection to that at all.

3678. And the same with regard to artificial colouring matters?—Yes.

FOURTEENTH DAY.

Monday, 15*th January*, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Dr. SAMUEL RIDEAL, D.SC., F.I.C., called; and Examined.

Dr. S. Rideal, D.Sc., F.I.C.
5 Jan. 1900.

3679. (*Chairman.*) You are a Doctor of Science and a Fellow of the Institute of Chemistry, I believe?—I am.

3680. I think you have come to certain conclusions about the toxic properties of boric acid used as a preservative in food?—Yes, I have done a good many experiments, and I have studied the literature of the subject.

3681. I think you know the trend of our inquiry, and I had better leave you to make any statement that you think necessary, unless you prefer to be asked questions?—I should prefer, I think, to be asked questions. I gave my views pretty fully in a joint paper with Dr. Foulerton, which was published in "Public Health" for May, 1899. In that paper we reviewed the literature of the subject, and recorded the results of experiments with a view to ascertaining the actual amounts of boric acid and borax on the one hand and formaldehyde on the other, which were necessary for preserving purposes in milk. As the result of those experiments we came to the conclusion that one part of formaldehyde in 50,000 was sufficient of that preservative to preserve milk even in warm weather for twenty-four hours. With regard to boric acid we used the mixture of boric acid and borax, instead of using either boric acid or borax alone in the proportion which is used by the trade; and we found that the proportion of about 1 in 2,000 was the quantity that was sufficient for preserving the milk for at least twenty-four hours even in warm weather. Having arrived at these conclusions, we then attempted to ascertain whether those quantities had any effect upon the digestibility of food when mixed immediately before the food was consumed or when kept in contact with the food as it would be for preserving, and determined the food digested at the end of twenty-four hours. These experiments are recorded in that paper, and as a result of them we came to the conclusion that the effect of these quantities of preservatives was inappreciable on the digestibility of the food even after contact for twenty-four hours.

3682. Whether in infants or adults?—We dealt there with the effect on digestibility, but not on animals nor on infants, nor on adults. Then the next part of that paper dealt with the effect upon man and animals which this quantity of formaldehyde had.

3683. You came to the conclusion that these proportions, 1 in 50,000 and 1 in 2,000, did not affect the abstract digestibility of food irrespective of the quantity of food taken?—That is so. The quantities of food digested in the presence of these preservatives were approximately equal to the quantity digested when the preservatives were absent. There was a slight retarding effect in many cases, but it was only slight; only a few per cent. of the quantity was not digested. I ought to point out at this stage that in these experiments the amount of digestion was determined after a certain length of time. The experiments with the blank and with the preservative were stopped after a length of time, and the amount of food digested in that time was determined. Of course, if the food containing the preservative had been allowed to digest for a little longer time, the presumption is that then that food would have been as fully digested as the food containing no preservative. The slight retardation noticed in taking equal times therefore measures the retarding effect of the preservative upon the food—the retarding effect, but not necessarily an inhibiting effect.

3684. The experiments were made *in vitro*, as I think the term is, is it not?—Yes, the digestion experiments were determined in glass tubes. I have followed those experiments that were published in "Public Health" by some others, an abstract of which I communicated to the meeting of the Sanitary Congress at Southampton, where there was a discussion on this subject, and those I have given in a supplementary *précis*, which I sent to your secretary with a view to defining what we meant by inappreciable extent. In those experiments I tested the effect of these quantities of formaldehyde and boric acid mixture upon the digestion of bread crumbs by determining the quantity of maltose produced from the starch in the bread crumbs. I compared the effect of the preservative with condiments, such as vinegar, salt, Worcester sauce, small quantities of alcohol, and infused tea. In these experiments I found that the quantity of maltose produced was practically the same when the preservative was present as when there was no addition of condiment. Vinegar, of course, had a very material retarding effect when 2½ c.c. per 50 c.c. were added. Worcester sauce in the proportion of one in fifty had a retarding effect. Five per cent. of alcohol had a less retarding effect than formaldehyde, but a little more than boric acid. Infused tea gave a figure of 91, and formaldehyde 88 out of a possible 100. Similar results were obtained using saliva for the digestion of starch. Then we also studied—at least this was not with Dr. Foulerton, this was my own work—the digestion of casein in the presence of formaldehyde, tea, claret, and Worcester sauce. In these experiments I found that the formaldehyde had no retarding effect in the time, whereas one-third of a gramme of tea, infused in 10 c.c. of water and mixed with 40 c.c. of milk, gave a figure of 97·3, so that small quantity of tea—one-third of a gramme, or 5 grains in 50 c.c. of milk and water, retarded the digestion of the casein in the milk; 10 c.c. of claret added to 40 c.c. of milk retarded the digestion in the ratio of 100 to 63. One c.c. of Worcester sauce and 40 c.c. of milk and 9 c.c. of water gave a figure of 84 against 100.

3685. So much for the direct effect of preservatives upon the digestibility of the various substances; there are other influences which take effect in digestion, are there not; I suppose circulation has a good deal to do with it?—Yes, and the cumulative effect of these things in the system of course would.

3686. You have spoken of the relative effect of alcohol, for example, compared with formaldehyde and boracic acid; I suppose alcohol has a certain effect upon the circulation when taken into the stomach?—Yes; I am not a medical man, you know; I am a chemist. That is rather a question for a medical man.

3687. But you have formed views, I understand, upon the amount of these preservatives that may be taken with safety into the system?—Yes, I have done feeding experiments on animals to supplement the artificial digestion experiments in glass. These experiments also show that the quantities of formaldehyde had no effect upon the nutritition of cats, or guinea-pigs, or rabbits.

3688. All these being adult animals?—The cats were three months old in the first experiments, and the rabbits and guinea-pigs were adult animals. I chose the cats at three months old because my first experiments with very young cats were not successful. I found a very great difficulty in feeding cats very young. I took them first of all about a month old—three to four weeks old—and, feeding them on milk in the ordinary way, I had six deaths, and I found that it was exceedingly difficult to feed kittens at that age by hand with undiluted cow's milk. The natural milk of a cat contains a very large quantity of albumen—6 per cent. of albumen—whereas cow's milk only contains about a half per cent., and it would seem that to feed very young kittens upon milk you would have to make up an artificial milk for kittens, much in the same way as an artificial humanised milk is made for very young children; so that those first experiments were done with cats three months old. But in August last, before Dr. Annett's experiments appeared, I fed some kittens with milk and formaldehyde, and milk and boric acid. These kittens I took as soon as they were able to take milk by themselves. Their age was then five weeks. I gave them 70 c.c. of milk per day, containing 1 in 50,000 of formaldehyde, and 1 in 2,000 of the boric acid mixture, which corresponds to about half a grain of borax per day. I found that those animals lived for three weeks; they gained in weight, so that the third week those fed on boric acid had increased 15 per cent. in weight.

3689. What was the proportion of boric acid to the milk?—The mixture of boric acid and borax was in the proportion of 1 in 2,000, and that corresponds to 35 grains per gallon, and the formaldehyde was 1 in 50,000, and the total quantity of milk per day was 70 c.c. The boric acid animals gained 15 per cent. in weight at the end of the third week; those with formaldehyde 14·1 per cent., and those without any preservative 18 per cent. Then I had an animal fed on a mixture of boric acid and formaldehyde. For the first fortnight it had the borated milk, and for the third week formaldehysed milk, and that animal gained 18·1 per cent.—just a trifle higher than the blank. So I conclude from those experiments that even with kittens at four weeks old these amounts of preservative had no effect when limited to that quantity of 70 c.c. per day. I have since read Dr. Annett's paper, which was published in the *Lancet*, and I see that he gives no information as to the quantity of milk that those animals had, so probably they had a good deal more of the preservative than mine.

3690. He told us he gave them as much as they would take?—Yes, he mentions that in the paper.

3691. Do you look upon these proportions which you have mentioned as the maximum which could be given with safety without any knowledge on the part of the consumer?—I do not think so; I think much higher quantities might be taken with impunity. The question resolves itself into the susceptibility of the individual.

3692. I use "consumer" in the singular number; I ought to have said without knowledge on the part of consumers. Of course, consumers are not all normal?—No; but one can hardly legislate, I think, for single individuals. Of course, there have been records of twenty grains of boric acid producing rash symptoms, but that would correspond to a very large quantity of milk; if you use 1 in 2,000 of milk and had a susceptible individual, an adult living on a milk diet, taking three pints or four pints a day, it would come to very nearly the dose which has produced rash in one or two cases which have been recorded.

3693. You say that it is not the part of the Legislature to take care of individuals, but surely there has been legislation for special classes of individuals, such as the inmates of hospitals; do you think it right that the purveyor of milk to a hospital should be at liberty to put an unlimited quantity of preservative into the milk without declaration?—Certainly not. I do not think anyone should be allowed to put an unlimited quantity of preservative into milk. I think the quantity should be limited, and it also should be declared.

3694. Then what I want to get at is what you think the proper amount?—I think the quantities that I have mentioned are suitable quantities for preservative purposes, and if they were declared they could be used by the majority with impunity; but invalids or very young children might buy or consume unpreserved milk.

3695. The quantities you declare being 1 in 50,000 formaldehyde, and 1 in 2,000 for the boric acid mixture?—Yes.

3696. I did not understand you to mention those as the maxima?—I do not think the trade require more than those quantities.

3697. That, you have said, is sufficient to preserve milk?—For twenty-four hours in warm weather. I believe smaller quantities than that would be sufficient if it could be arranged that the preservative were added at the time of milking the cow. For example, I believe that 1 in 75,000 of formaldehyde would be quite sufficient for trade purposes if the formaldehyde could be added to the milk immediately the cow was milked.

3698. Why should it not be so added; it is so in many cases, is it not?—No, I think that preservatives are not added immediately. Preservatives are not added until sometimes some hours after the cow has been milked, and then the changes have already taken place to such an extent that then the quantity of preservative must be higher for keeping it for twenty-four hours. The initial acidity of milk is very small, but even in two or three hours the acidity increases very markedly. I have taken milk from a cow in Westminster which is used for supplying the Hospital with pure milk, and milking it practically into the can, and then, examining it after an hour, I found the number of organisms increased very rapidly and also the acidity, so that you get an acidity of 0·18 per cent., calculated as lactic acid in milk even an hour or two after milking, and the maximum acidity is about 0.25 per cent. before the milk sours, so that more than half the acidity is produced in the first hour or two.

Dr. S. Rideal,
D.Sc., F.I.C.

15 Jan. 1900.

3699. You are not aware of any difficulty in applying the preservative immediately after the milking?—I should not think there is.

3700. We have had it in evidence that with the milk supply of Southampton, for instance, it is done by a great many farmers?—Yes, I know it is done by a good many farmers, but it might be done by all.

3701. I think you have some Tables to put before us?—Yes. (*See App. No.* 24.)

3702. (*Professor Thorpe.*) I should like to ask you one or two questions about one of those Tables which you have handed in—I mean the Table which you give on page 5 of your *précis*. The way you have measured, I understand, the preservative effect of these two substances, boracic acid and formaldehyde, was by taking a certain amount of milk, in which you ascertained the acidity, and then you added the preservatives in the proportions that you have told the Committee were in your judgment suitable amounts?—Yes.

3703. You incubated the milks at various temperatures and then determined the change, namely, the degree of acidity, by volumetric analysis?—Yes.

3704. May I ask, in the first instance, what degree of accuracy your experiments warrant you to assume? Do you attach any significance to the third decimal place to which you reproduce them?—No, I do not suppose they are accurate to the third place.

3705. To how many places of decimals do you think that you are warranted in going?—I should think the second place, in terms of lactic acid, might be approximately correct.

3706. The second place is approximately correct?—Yes.

3707. It appears from this Table that you have given to us that when the milks are incubated at 13 degrees centigrade, or 55½ degrees Fahrenheit, practically no change takes place resulting from the preservatives?—Yes, that is so.

3708. The milks suffer no change even at the end of thirty-nine hours?—Yes.

3709. In other words, the preservative is not required at all if the temperature does not exceed that particular limit?—No, not in this sample of milk.

3710. (*Chairman.*) Does that temperature refer to the atmosphere, or is it the temperature to which the milk is raised?—It is practically atmospheric temperature.

3711. (*Professor Thorpe.*) You mean that the milk was at this temperature?—Yes.

3712. (*Chairman.*) Not that it was in that temperature?—I think, as a matter of fact, the first series at 13 degrees centigrade were done in the open laboratory.

3713. (*Professor Thorpe.*) What you mean is, that when milks are kept at these particular temperatures they suffer such and such changes; that is what you really wish to imply?—Yes.

3714. It is a pity you did not say, if this Table is to be printed, that they were not really all incubated?—The higher temperatures were.

3715. In your *précis* you state that they all were. It does not so much matter, but it is perhaps an unfortunate expression when you have now to admit that the others were at the ordinary temperature of a laboratory, which surely would be rather variable, because the ordinary temperature in a laboratory would be running up and down several degrees; but now you tell us that they were not kept at a precise point of temperature?—They were kept in a separate laboratory at that temperature; we

Dr. S. Rideal,
D.Sc., F.I.C.

15 Jan. 1900.

had a thermometer in the room the whole time of course, it was practically the temperature of the day.

3716. You put this forward as being substantially a temperature of 55½ degrees Fahrenheit?—Yes, the first one.

3717. We gather from your figures that no change happened in the milk?—None whatever.

3718. Then there is no use in the application of preservatives at this temperature?—No, not at that temperature in this case.

3719. Now we will turn to the next, which are temperatures of what we may call the normal summer day; that is about 64 degrees Fahrenheit, or 18 degrees centigrade?—Yes.

3720. You tell us you attach no importance to the third decimal place, and we will neglect it; it seems, therefore, after fifteen hours that a very slight amount of change took place?—Yes.

3721. Namely, 0.20 in the untreated milk, and 0.18, 0.18 respectively in the others?—Yes.

3722. In twenty hours we also find, neglecting the third decimal place, and bearing in mind what you said that even the second decimal place is only approximately right——?—Yes.

3723. Even after twenty hours, at 18 degrees centigrade, there was practically no change in the milk?—No.

3724. The same is true, or very nearly true, after twenty-three hours?—Yes; there is a little more difference, of course.

3725. Very slightly more, but no greater difference than there is in one of the previous experiments?—That is so.

3726. Therefore, it appears after twenty-three hours at the temperature of a summer's day there was no necessity to use preservatives, as shown from your experiments?—Yes, in this particular case.

3727. Now we will take the extremely hot weather, which is represented by 24 degrees centigrade. We have precisely a similar state of things, namely, that the preservative practically showed no preservative effect?—Yes, it is very slight.

3728. I put it to you, whether, being so extremely slight as it is, it is worth while adding the preservative at all?—The difference, of course, depends upon what you might call a sour milk. I have fixed in my own mind 0·25 of acidity, calculated to lactic acid, as a milk which would be rejected by a consumer.

3729. As being sour, or turning at all events?—Yes.

3730. Do you think that a consumer would be able to appreciate the distinction in sourness between, we will say, 0·23 and 0·22 of lactic acid?—No.

3731. Would he be able to appreciate the distinction in sourness between 0·28 and 0·24 of lactic acid?—Yes, I believe he would.

3732. You think he would?—Yes.

3733. In other words, he would be able to appreciate the distinction?—Not in the taste, but in the properties of the milk; one would curdle, and one would not.

3734. You think milk would not curdle at 0·24 and would curdle at 0·28?—Yes.

3735. Under all circumstances?—I would not be prepared to say under all circumstances. I think that normal milks would show that difference.

3736. You mean that a difference of four-hundredths of a per cent. of lactic acid would make the difference in the curdling of the milk?—Yes.

3737. Other experiments than your own have been made on the degree of acidity at which milk curdles?—Yes, Thörner's experiments, for instance.

3738. Is the variation between yours and his greater than this difference of four-hundredths of a per cent.?—Yes, I think it is a greater difference than four-hundredths.

3739. It is very much different; then I put it to you again—the error of experiment in the determination of the point at which the milk would curdle is very much greater than is represented by this number—0·04 of a per cent.?—Yes; for comparison it is necessary to define what is meant as curdling by different observers.

3740. I put it to you that you could not determine the point at which milk would curdle in two successive samples of the same milk within 0·04 of a per cent.?—No.

3741. You admit you could not?—Would you mind repeating that?

3742. You could not determine on two successive samples of the same milk the point of curdling within 0.04 per cent.?—On a single sample I believe the point of curdling must be pretty sharp.

3743. But you have just told us that you attach only an approximate value to the second decimal place?—You are talking about a difference of 0·04.

3744. What degree of accuracy do you attach to the second decimal place?—There must be in a given milk a fixed point at which it curdles, and I believe if one took the acidities with a variation of 0·01, one would be able to ascertain sharply the acidity at which the milk curdled.

3745. Within what degree of accuracy could you do that, do you think?—I believe with 0·01 per cent. of acidity you would be able to divide them up into a group of those which curdled and those which did not curdle.

3746. Again, I put it to you that the error of your experiment, the mere determination of your acidity, approximates to that error of 0·01?—Yes.

3747. Very well, then, you know that even the error of the experiment is 0·01?—In a series you can work it much closer than you can by an individual test. One could ascertain the acidity, mounting up gradually and determine the curdling effect, say, every half hour; the acidity would slowly increase, and there would be a point at which you would say, "Now this milk is curdling."

3748. The curdling being the only test practically whether the milk becomes unsaleable, is that it?—I should think that is the principal test.

3749. You have admitted that the consumer could not distinguish its taste?—No, not with those quantities of acidity.

3750. All that he would be able to distinguish would be that at some particular point, in your opinion, represented by a degree of acidity of 0·04 per cent.—four-hundredths of a per cent.—of lactic acid—a difference of that figure would prejudice him by, in the one case, the milk curdling, and in the other case, not; that is your view?—Yes.

3751. Do you seriously tell the Committee in view of these figures that you put before us, and in view of the statement that you yourself have made that one part in 2,000 of boric acid and one part in 50,000 of formaldehyde are proper and sufficient; do you seriously tell the Committee that it is worth anybody's while in view of these figures to use these preservatives?—I am not a milk vendor, but it apparently is worth their while, or they would not use them.

3752. On those figures is it worth while, taking you on your own showing, on the experimental evidence that you have afforded the Committee?—I can only say that there is a point at which milk curdles, and I believe it to be about 0·25, and therefore it looks as if, in order to keep milk for twenty-four hours, one must ensure that the acidity does not reach higher than 0·25.

3753. I take you again on that point of acidity; you are not in agreement with other persons who have determined the point at which curdling takes place; the discrepancies between individual experimenters are very much greater than this limit that you have told us of?—Yes, they define curdling in different ways.

3754. Therefore you could not really attach very much importance to this limit of 0·04 in view of the fact that two independent series of experiments afford no warrant for it; the difference between individual experimenters is far greater than between this limit of 0·04?—Yes.

3755. Therefore I put it to you, as an experimenter, what is the value of it?—Of course the retardation of the acidity, even if it is only a very small amount, is an advantage, whatever the actual quantity at which the curdling takes place.

3756. No doubt there must come a time in which the milk with no preservative in it breaks down, but I put it to you that in any milk which is kept under ordinary conditions for the length of time which milk is usually kept for purposes of sale, these amounts of preservative that you have given us as being proper and sufficient, are practically of no avail?—I do not at all agree with you.

3757. I am only taking you on your own figures; I want to find out how your figures show otherwise?—I think they show that there is just sufficient retarding to produce the desired effect.

3758. I venture, with all deference, to say that my in-

Dr. S. Rideal, D.Sc., F.I.C.

15 Jan. 1900.

terpretation of your figures is correct, that there is no substantial retarding effect, and that the difference makes it not worth anybody's while to use preservatives within the limits that you have told the Committee are in your judgment sufficient?—You must recollect that in this table that you are referring to, the original milk used had a very high acidity, namely, 0·18. As I mentioned to the Chairman just now, my view is that the preservative should be added to the milk before any appreciable acidity has started.

3759. (*Chairman.*) Was the interval between milking and bottling the milk for incubation uniform in every case?—In every case on this table, yes; it was the same milk.

3760. How long?—I think it was about two or three hours, but I do not remember the exact time.

3761. And that is an element of uncertainty?—Yes.

3762. (*Professor Thorpe.*) You say in another part of your *précis* that you believe consumers prefer preserved milk, as it enables them to keep their milk for a few hours, or even over night for an early breakfast; what precisely is the evidence on which you base that statement?—Personally I have had a difficulty in getting milk for early morning breakfasts, and I have therefore had to use the milk of the previous night. That milk, if it contains a preservative, is sweet in the morning.

3763. It may or may not be; and if it is not?—It passes for the morning breakfast; if it had no preservative it would be sour and unsuitable for the morning breakfast.

3764. If it is your intention to preserve your milk overnight, I suppose it is open to you to get the afternoon's supply of milk, or the evening supply of milk, for that purpose, is it not?—I say that I do; I get the evening's milk, which is sold really for the evening supply, and it is kept over for the early morning breakfast.

3765. At the early morning breakfast how old do you think that milk is when you are consuming it?—I do not think anything about it; if it is sweet I use it.

3766. As a fact, in the nature of things, how old would it be, that is, how long would it be before it reaches you?—It is probably about twenty-four hours old.

3767. That is to say, it is practically within the limits you have given us, in which no change takes place?—In winter weather, mind.

3768. Or even in summer weather?—In summer weather it depends upon the temperature; at a high temperature it would be gone even then.

3769. It is an extremely high temperature when you tell us of 24 degrees centigrade. That is a most abnormally high temperature, certainly in the night?—Yes.

3770. Therefore there is no necessity in your particular case, for the early morning breakfast, to have recourse to preservatives?—I do not go as far as that.

3771. I am only taking you on your own figures, you know?—I understand.

3772. (*Dr. Tunnicliffe.*) With regard to the pancreatic digestion of casein, I take it that you estimated the amount of nitrogen in the filtrate after digestion?—Yes.

3773. May I ask you how you filtered the digestive mixture?—Yes, only a portion was filtered.

3774. I quite understand that; 10 c.c. you say?—Yes, it was filtered through paper.

3775. How long did it take to filter that?—It does not take very long if you only take a small quantity, as we have done. It is very difficult, of course, to filter the whole, but you can filter a small quantity in half an hour or three-quarters of an hour.

3776. You had no difficulty anyhow in filtering 10 c.c. in three-quarters of an hour?—No, I think not.

3777. (*Dr. Bulstrode.*) With regard to the questions Dr. Thorpe asked you just now as to the consumers preferring milk with a preservative, could that not be covered by the consumers adding the preservatives themselves?—I think then one runs the risk of Dr. Robinson's case. If you leave the preservatives to be added by consumers haphazard, you will have greater risks than if they are added legally by a farmer under control.

3778. Of course, if you legislated against the use of preservatives altogether, there would be no risk of a previous party, conceivably, adding it, and these patent preservatives have instructions as to the amounts to be used, so that the consumers might fairly guard themselves?—We do not know how much was added to the blancmange in Dr. Robinson's case. That was added apparently in very large quantities.

3779. Have you gone into the evidence of that case?—I have read about it.

3780. Are you quite satisfied with it?—No, but I do not think it was due to the boracic acid.

3781. I take it the main point in your paper is really to show, or to bring out, what in your opinion is necessary to preserve the milk for the purposes of trade—that is your main point?—Yes.

3782. But you are not prepared to give any evidence as to whether or not much larger amounts would be prejudicial to health?—No, I am not.

Major Charles Edward Cassal, F.I.C., called; and Examined.

Major C. E. Cassal, F.I.C.

3783. (*Chairman.*) You are Public Analyst for Kensington, St. George, Hanover Square, Battersea, High Wycombe, and Administrative Counties of Kesteven and Holland, Lincolnshire?—Yes.

3784. You are also District Agricultural Analyst for the Administrative County of Kesteven, Lincolnshire, and Consulting Scientific Analyst to the "British Medical Journal"?—I am.

3785. You are also a Fellow and Past Censor of the Institute of Chemistry of Great Britain and Ireland, Joint Secretary of the International Commission on Adulteration, Fellow of the Sanitary Institute of Great Britain, and Fellow of the Chemical Society of London?—Yes.

3786. For several years you were Chief Demonstrator in the Department of Hygiene and Public Health at University College, London?—Yes.

3787. Have you devoted, in the course of your duties, attention to the subject which is under our inquiry just now?—I have devoted a good deal of attention to it.

3788. Are there any points in your experience which you think it would be useful for us to have before us?—Yes. I think it is necessary that the position of the public analyst in regard to preservatives and colouring matters should be clearly defined by the Legislature or by an authority delegated by the Legislature. Under the provisions of the Sale of Food and Drugs Act public analysts are required to report whether the articles submitted to them are "genuine" or "adulterated." In order to do this the public analyst must have a definition, and if that definition is not provided for him he must make one. It is plainly undesirable that the duty of deciding what shall and what shall not constitute adulteration, in matters so intricate as the use of preservatives and colouring matters, should be placed on the shoulders of individual public analysts. In order to decide in certain cases whether an article is to be considered as adulterated or not the public analyst must know whether certain substances are "injurious to health." It has been assumed by the Legislature that the injuriousness or non-injuriousness of a substance is a matter to which no doubt can attach, and in regard to which there can be no differences of opinion. As a matter of fact it is a most difficult thing to prove to the satisfaction of a Court of Law that a particular amount of a particular substance present in an article of food should be regarded as rendering that food "injurious to the health" of the consumer. There are certain substances which are mixed with food in regard to which there exists no positive evidence to prove that, when ingested by man, definitely injurious effects are produced; although, upon theoretical grounds, it might justly be presumed that they would be injurious. It should be the business of the Legislature to ensure that the necessary experiments should be carried out, and that the necessary information should be obtained, at the expense and under the direction of the Government.

3789. Is there any definition of a poison or a drug?—Not so far as the Sale of Food and Drugs Act is concerned. I do not know that I quite appreciate what you wish to ask me there.

3790. Would you say that a substance which was specified in the Pharmacopœia to be taken in certain quantities would be a drug?—Certainly I should think that would be enough to show that it would be a drug.

3791. Is there any corresponding definition as to a

Major C. E. Cassal, F.I.C.

15 Jan. 1900.

poison?—Not in so far as the Food and Drugs Acts are concerned. I believe there are definitions of poisons in connection with the Pharmaceutical Acts.

3792. (*Professor Thorpe.*) Is that alone enough, because brandy is in the Pharmacopœia; is that a drug?—Of course, there are a number of things in the Pharmacopœia which are obviously not to be regarded as drugs. As to brandy, some people regard this as a drug, but everybody does not regard it as a drug. There is honey, for instance, also, which would hardly be regarded as a drug.

3793. That because a thing is in the Pharmacopœia it is *ipso facto* a drug I am afraid would scarcely be a workable definition?—I rather understood Sir Herbert's question in another way. I had in my mind such substances as boracic acid, salicylic acid, and so on; I was not, I admit, at the moment thinking of such a thing as brandy or of such a thing as honey, although there are some people who would contend that brandy was a very dangerous drug.

3794. But no one would contend that honey was?—No one would contend that, I take it. In considering matters of the kind now engaging the attention of the Committee it is necessary to bear in mind that there are certain principles which cannot be departed from without grave injury resulting to the public and to the better classes of manufacturers and vendors of food products. These principles may be stated as follows:—(1.) The Select Committee of the House of Commons on Food Products Adulteration came to the conclusion that "the vital provision" of the Sale of Food and Drugs Act, 1875, is "to prevent the purchaser from being supplied to his prejudice with an article whose composition differs from the composition of the article that he is supposed to desire and has demanded." (2.) A purchaser cannot be supposed to know, either on account of the cheapness of an article, or, in most instances, on account of its nature, that it is not in all respects what he has asked for. (3.) The purchaser is not able to protect himself, and the Acts were passed in order to protect him. (4.) The purchaser is entitled to full and clear disclosure of the exact nature of an article and its composition. (5.) A poisonous substance, or a substance having active characters as a drug, should not be used in the preparation of food. (6.) The manufacturer and vendor of pure and genuine articles must be protected from unfair competition. (7.) The pecuniary interests of manufacturers and vendors are a secondary consideration. The Acts were passed for the protection of the public and the protection of the makers and vendors of pure and genuine products. The public analyst is concerned solely with the public interest, and cannot take the convenience or the pecuniary interest of any particular trade into consideration. In consequence of the condition of the law the public authorities concerned with the administration of the Acts relating to adulteration have met with great difficulties in carrying out their duties. In regard to preservatives and colouring matters especially, public authorities have been put to great trouble and expense in order to prove offences. That, I may say, is within my own experience with my own authorities.

3795. (*Chairman.*) Have you any experience of convictions with regard to these offences?—Yes, I have a number of instances.

3796. But there is great uncertainty, I suppose, in the event of prosecution?—There is always a great uncertainty in those cases, because the difficulty of proving injury to health always comes up, and the authorities, as a rule, are unwilling to spend the necessary money to ensure the attendance of a sufficient number of expert witnesses. A case has been heard recently which you have no doubt seen the reports of, and which is going to appeal, in which clotted cream containing boracic acid was the matter under the consideration of the Court. I believe that case has been alluded to already before the Committee. It was one of my cases, and I have got the facts relating to the conviction here, if the Committee would like to have them. I could give them now or later on, as you may wish.

3797. It would be better to do so later on, I think. You have quoted the Committee of the House of Commons on the Sale of Food and Drugs Act, 1875, as having reported that the vital provision of this Act was "to prevent the purchaser from being supplied to his prejudice with an article whose composition differs from the composition of the article that he is supposed to desire and has demanded." Are you aware that the difficulty of the magistrates in these prosecutions arises from the words "to his prejudice"?—I do not think that much difficulty arises about that now. Some years ago, prior to the passing of the Amendment Act of 1879, those words were sufficient to cause the failure of prosecutions; but although, of course, they are certainly used now on behalf of defendants if an article is proved to the satisfaction of a magistrate to be adulterated, in my experience, at any rate, I have not noticed that he attaches very much importance to those particular words.

3798. (*Professor Thorpe.*) That is your individual experience?—Yes.

3799. We have had it in evidence, you know, from many officials that they have found difficulties, and, indeed, have declined now to bring actions on the ground of the difficulty of proving prejudice?—I have not noticed in my own experience that very much attention has been paid to that. Of course, I must speak carefully on that point, because it is really a legal question, to which, perhaps, a public analyst does not always pay very keen attention; but in so far as injury to health is concerned, if an adulterant is proved to be injurious to health to the satisfaction of the magistrate, he would regard its sale as being to the prejudice of the purchaser. I have not noticed myself that any very strenuous line has been taken upon those words, lately at any rate.

3800. Have you read our evidence as it is reported in the public prints?—I have not been able to read it very carefully, but I have gone through it.

3801. That point has come up two or three times; we have not unfrequently heard that public authorities have declined to take action on account of the difficulty of proving prejudice?—There are a great number of difficulties in these cases, and some public authorities are very chary about taking action, but that does not apply so much to the authorities with which I am connected in London, who hold rather strong views about the suppression of adulteration. Their chief objection to taking action, I think, is on the score of expense.

3802. (*Chairman.*) Will you now proceed with your statement, please?—The admixture of preservative chemicals with articles of food for the purpose of keeping them in a saleable state, and also for the purpose of enabling stale, inferior, and even actually bad articles to be palmed off on the public as good and fresh, is a practice which has become very widespread. It is alleged by the apologists for this practice, and by those who are obviously interested in its unrestricted continuance, that the "public demand" for many articles of food can only be met by the use of preservative chemicals. Apart from the question of cheapness, this argument is disposed of by the fact that the articles in question are largely and successfully sold without the admixture of any preservative chemicals at all. If it is held to be necessary that preservative chemicals must be used in order to provide these articles at a sufficiently cheap rate to meet the demand of a large proportion of the population, then a full and particularly clear disclosure of the nature and amount of the preservative chemical used, and of its possible effects, should be compulsorily made to the consumer.

3803. Apart from the question of cheapness, if this argument is disposed of by the fact that the articles in question are largely successfully sold without the use of a preservative, do you think it is possible to conduct the milk supply of an enormous city such as this without the use of preservatives at all seasons?—I think so undoubtedly.

3804. What do you base that opinion upon?—I base it upon information that I have obtained in the course of my official work, from the large milk dealers who sell milk in my districts. Take the Aylesbury Dairy Company, for instance. They provide milk for an enormous district, and for an enormous number of customers, and they never use any preservative at all—in either their cream or their butter or their milk. I do not know whether I ought to mention the names of those firms, but there are other large firms that I know of, one in Kensington, for instance, who never use any preservative at all; and the view of the persons in authority in those firms is that it is not only possible but right and proper that the milk supply of a large city should be free from preservative chemicals. They adopt cold treatment, and they find that works quite satisfactorily. In the case of cream, to which I was referring just now, my authority of St. George, Hanover Square, subpœnaed the analyst of the Aylesbury Dairy Company, Mr. Droop Richmond, who is very well known in connection with milk products, to give evidence; and he asserted in the witness-box that his company made no use of preservatives, and that he did not consider it in the least necessary to do so.

Major C. E. Cassal, F.I.C.

15 Jan. 1900.

3805. You have mentioned some of the large companies supplying the wealthier parts of the town, but it has been represented to us that a greater difficulty would arise when you come to supply the East End of London, and when milk gets into the hands of the very small men there, and there is an uncertain demand for it?—Yes, I have heard of that. I may mention here incidentally that I think it is exceedingly undesirable that the supply of milk should be in the hands of small vendors, on the ground of the danger attaching, and always attaching, to the supply of milk—I mean from the health point of view. If the milk has been properly treated at the farm by being cooled and so forth, and if it is properly stored by the persons who sell it, it is not necessary to use chemical preservatives. I would submit that for the relief of the small vendor it is undesirable to allow the introduction of drugs into milk.

3806. (*Professor Thorpe.*) What kind of machinery do you contemplate if you are going to sweep away the small vendor?—Of course the use of preservatives enables the small vendor to keep his article for a lengthened period. No doubt it is to his pecuniary advantage to be able to keep this article and to sell stale milk as fresh milk, which is one of the principal results attained by the use of chemical preservatives, but a person who sells milk should have the appliances necessary to supply it in a pure and satisfactory condition, and if he cannot afford to have those appliances he should give up the sale of milk.

3807. That is not quite an answer to my question; of course theoretically that is quite right, but I do not quite understand by what kind of organisation you are going to distribute milk in the East End of London?—By cold storage I mean that the vendor of the milk must receive the milk from his farmer or a wholesale vendor in a pure condition, and that he must take steps by cold storage to sell it fresh and pure.

3808. That means in effect, I suppose, the creation of large distributing centres with a considerable amount of capital at the back of them?—I hardly think so. I think that cold storage is not such a very difficult matter after all, and I have it on the authority of Mr. Droop Richmond that even small establishments are able to keep up small cold storage places which are amply sufficient to enable the milk to be sold in a proper condition within a reasonable time; and I do not myself see why it should not be so.

3809. (*Chairman.*) The districts in which your duties lie are mainly those of the better class of inhabitants, I think?—No, not entirely; one of my districts in London is a very poor one, namely, Battersea.

3810. What do you find there as regards the milk supply?—There is more adulteration.

3811. How is it supplied with milk generally—is it supplied by small vendors or by large companies?—By both. There are large vendors that supply in Battersea, and there are also a great number of small vendors. It is also true that prior to the fairly energetic application of the Acts by the Battersea authority there was a very great deal of adulteration in Battersea—adulteration of milk particularly.

3812. Adulteration, not in the sense of the use of preservatives, but fraudulent adulteration?—As fraudulent adulteration, chiefly. But, of course, preservatives are also found there just as in other districts. It is important to remember that the substances used are not themselves foods (with the exception of common salt in moderate amount), and they must be regarded as drugs. The substances chiefly employed are boracic acid and borax, or mixtures or solutions of these substances: salicylic acid, and formaldehyde. Benzoic acid, probably as benzoate of soda, is used in some cases, but to a very much smaller extent, and a preparation known as borofluoride appears also to be used in certain cases. In my opinion any of these substances when present in food products must be regarded as a "foreign ingredient" within the meaning of the Acts. Their unacknowledged presence constitutes adulteration apart from any question as to their injuriousness. The legalising of the use of preservative chemicals in certain articles of food, as is done, for instance, by the Margarine Act, cannot affect the conclusions to be drawn from the fact that these substances are not normal constituents of food products. The principle which I have put forward as the scientific ground upon which I base my objections to the introduction of preservative chemicals into food products may be stated as follows:—When a preservative chemical is mixed with a food product it is added in sufficient amount—at least—to exert its specific effect on the food, and is liable to be added in much larger amount than is necessary to get that effect. . . . .

3813. Is that by successive additions?—Yes, and also by the fact that if there is but one addition the person who employs the preservative will add enough to "make sure," which is probably a very much greater amount than is absolutely necessary for the preservative effect. Continuing the argument I was about to lay before you, if a preservative chemical is present in a food in sufficient amount to exert its specific effect on that food, that fact is, in itself, sufficient to show that the digestion of the food by the consumer must be injuriously affected, and such admixtures must therefore be regarded as "injurious to health." It has been stated, in effect, before the Committee that if the precise quantity of a preservative chemical necessary for preserving a food is present in that food there is none of it left to act upon the organism. Assuming this to be so, the fact is lost sight of that it is the prevention or retarding of the digestion of the food itself by the presence of a preservative in it that constitutes injuriousness, apart from any extra injury which may be brought about by quantities in excess of those necessary to exert the preservative and inhibiting effects. In my opinion the use of preservative chemicals is unnecessary so far as the public advantage is concerned; while, no doubt, their use may be advantageous to certain manufacturers and vendors for pecuniary reasons.

3814. On that question have you had any experience of foreign and colonial butters?—I have had, of course, a very large number of butters to examine, but they do not reach me in such a way as to enable me to know where they come from. No information is given to the public analyst as to the source of the samples that are submitted to him, and I am therefore unable to say which were colonial, and which were foreign, and which were English of the butters examined by me. You see, they reach the public analyst under a number, "Butter so-and-so," and one does not know what the origin of the sample may be.

3815. I do not understand you to advocate the prohibition of preservatives, merely their declaration?—I must say that my desire is to advocate the prohibition of all preservatives rather than to allow them to be used even with disclosure, but if the Committee do not see their way to recommending that, I certainly think that the next best thing is disclosure.

3816. Will you go on, please, with your statement?—The proper legitimate methods of preserving food when preservation may be held to be required are the probably more expensive methods of refrigeration and sterilisation, which have been shown to meet all reasonable requirements. I consider that the use of any known preservative chemical other than common salt (the presence of which is at once detected by taste, and which is itself a food, and an important constituent of the body) is unnecessary and objectionable, whatever quantities may be employed. In 1891 the Vestry of Kensington decided to obtain the opinions of certain eminent medical authorities upon the use of boracic acid for the preservation of articles of food. The medical authorities consulted were the late Sir Andrew Clarke, Sir Henry Thompson, and Dr. Lauder Brunton. Copies of the replies received from these authorities, which were entered on the minutes of the Vestry, I have here, and I can hand them in in print. In 1893-94 the Vestry of Kensington thought it desirable to obtain a definite opinion from the Local Government Board with respect to the addition of boracic acid compounds to butter. I have here extracts from my annual report as public analyst for Kensington for the year ending the 31st March 1894 (*See App. No.* 25.), containing the correspondence on the subject, and an extract from the Local Government Board's Report referring to the matter, together with a statement of the attitude which I have since adopted, in so far as my official work is concerned, in regard to the addition of boracic acid to butter. That attitude is simply this—that in view of the reply of the Local Government Board to the Vestry's question and of the portion of their report referred to in that reply I have felt compelled, since, to report samples of butter containing boracic acid as genuine, but with the information that they did contain boracic acid whenever it was found; and still adhering to my own personal view that the presence of boracic acid in butter constitutes adulteration. I submit some examples taken from my own reports of the use of boracic acid for preserving articles of food. I have found boracic acid present either as such or as a mixture with borax, or as borax, in sausages, meat extracts, meat juices, potted meats, potted fish, potted caviare, milk, skimmed milk, separated milk, butter, margarine, wine, cream,

Major C. E. Cassal, F.I.C.

15 Jan. 1900.

potted cream, and Devonshire cream; salicylic acid in meat juices, syrups, jams, lager beer, wines, British wines, and lime juice; formaldehyde in milk, skimmed milk, and separated milk; benzoic acid probably present as benzoate of soda in non-alcoholic and medicated wines. Then I have some examples of the quantities found which I may submit to the Committee. I do not know whether I need read them all; I may refer perhaps to one or two of them. I may say these are all cases which have occurred within the last two years. The highest of these (in milk) was a case of 0·0821 per cent. of boric acid as B_2O_3, or boron-trioxide, which is equivalent to 59·12 grains per gallon of boron-trioxide (B_2O_3) and to 100·7 grains per gallon of crystallised boracic acid H_3BO_3.

3817. (*Professor Thorpe.*) I do not think you have said what that was in; at least, I did not gather?—It was in milk. I may perhaps explain for the information of the Committee that I found it to be necessary in these cases to give the percentage of boron trioxide first and the equivalent amount of boracic acid (H_3BO_3) in grains per gallon; for the reason that the certificates under the Act require the public analyst to state that a sample contains "the percentage of the foreign ingredients as under, or the parts as under," and in order to meet the legal difficulty it is necessary to state a percentage. Then, in order to make it clear to the Court, it is necessary to state the amount in grains per gallon. Further, in view of the fact that the preparations of boracic acid chiefly used are frequently mixtures of borax and boracic acid, it is necessary to have a definite substance—a bed-rock substance, as it were—to proceed upon. Now, it does not matter whether you have got "borax" as the preservative used or "crystallised boracic acid," or, as I have found by examining some of these preparations, a mixture of partly exsiccated crystallised boracic acid (which would mean the presence of a certain amount of boron trioxide), of powdered crystallised boracic acid, and of powdered borax—I say it does not matter as long as you return your percentage first as so much boron trioxide. That struck me as being necessary in order to meet the legal requirements in cases of this sort, and it is for that reason that I have got the three statements in my proof of evidence. There are a number of other cases where I have determined the boracic acid. There are four cases together where the amount of boron trioxide was about 0 04 to 0·05 per cent. With regard to those I should say that they were samples taken all at or about the same time, and they show that about the same amounts were being used. The smallest amount that I have found in milk when the quantity has been sufficiently appreciable to warrant a quantitative determination was 0·015 per cent. of boron trioxide (B_2O_3), which is equivalent to 19·25 grains per gallon of crystallised boracic acid (H_3BO). With regard to cream, the amounts that I have found, which I can also put in, are considerably higher than in the case of milk. The highest amount was 0·291 per cent. of boron trioxide, which is equivalent to 0·515 per cent. of crystallised boracic acid, and to 36·05 grains per lb.

3818. Per lb. or per gallon?—Not per gallon; you cannot state it per gallon in the case of cream conveniently. In the case of cream I state the percentage of boron trioxide and the percentage of crystallised boracic acid, and the number of grains per lb. The lowest amount in the case of cream was 0·104 per cent. of boron trioxide. With the exception of the last two cases quoted those were cases of clotted cream.

3819. (*Chairman.*) That trade would be considerably interfered with, would it not, if preservatives were not introduced?—It is a trade question, of course, but not according to the views of the Aylesbury Dairy Company and other vendors who supply cream without any preservative in it, and who say they find no difficulty in selling the product within reasonable limits as to time.

3820. The question would not be so important to the public in the matter of cream, would it, seeing that cream is not taken in such large quantities by the consumer?—No, I do not think it could be as important as in the case of milk, which, of course, is so largely used by children and invalids, but our medical witnesses in recent clotted cream cases brought forward the view that inasmuch as cream was now prescribed by medical men in the place of cod liver oil, and also prescribed by medical men for mixing with milk and enriching it for feeding children, it was held by them that there were special dangers attaching to the practice. That evidence was given in the recent cream case to which I was referring just now.

3821. You have examined the milk as supplied to certain hospitals, I think?—Yes, I have at different times examined samples of milk for some large institutions, and for some of the London hospitals—for one especially of the London hospitals. I have not in any of those cases determined the quantity of boracic acid present, but in a number of instances I have found the boracic acid preparations to be present. I am not able to give the exact number.

3822. Leaving the milk trade, we now come to wines, in which I think the preservative is a different one?—Yes, it is salicylic acid, as a rule. With the exception of British wines I have not come across large quantities of salicylic acid in wine, but I have found it to be present in small amounts, in samples of port wine particularly, from mere traces equal in the lowest case to 0·245 grains per gallon of salicylic acid to 0·7 grain per gallon of salicylic acid, and 1·4 grains per gallon and 3·15 grains per gallon in certain cases of port wine.

3823. Salicylic acid is never a native acid in wine, is it?—No.

3824. It must be added?—Yes, it is a foreign ingredient absolutely. In sherry I have found 1·6 grains per gallon of salicylic acid. In so-called British wines I have had cases where there have been large amounts of salicylic acid.

3825. Would such a small amount as 0·7 grains per gallon have any appreciable preservative effect upon port wine?—I do not think that amount would. It is very difficult to say how those amounts were present. I am inclined to think that it was due probably to the blending of the wine with other wines containing larger amounts. I have some ground for that, because large wine vendors who have consulted me with reference to this matter have told me that it is the practice to blend wines of this kind, especially the cheaper sorts.

3826. The cheaper sorts would be those that would be most likely to have the preservatives?—Yes, probably. Taking British wines, in orange wine I have found as much as 26·6 grains per gallon of salicylic acid; in a wine called British sherry I have found 11·55; and in black currant wine 4 grains per gallon of salicylic acid. There was a prosecution in the case of the orange wine by the public authority—in this case the Vestry of St. George's, Hanover Square—and the case was dismissed after a great deal of medical evidence had been given on behalf of the defence as to the alleged absolute non-injuriousness of salicylic acid. I will hand in the details of that case in print if the Committee wish.

3827. Then as to beer?—In beer I have found salicylic acid occasionally. I have cases here of bottled beer, 7 grains per gallon; and Pilsener lager beer, 4·76 grains per gallon.

3828. Here again the consumer would be supposed to take a much larger dose; he would drink beer more liberally, I hope, than black currant wine?—Yes, very probably. I might say that there is not very much opportunity for the public analyst to get information about beer, because the number of samples of beer taken under the Acts is not very great. There is no definition as to what is to constitute beer, and the public analysts do not get many samples.

3829. You have also found it in lime juice, I believe?—In lime juice I have found a great amount—in a particular case as much as 69·3 grains per gallon of salicylic acid—practically 70 grains per gallon, which is 0·1 per cent.

3830. Have you found other lime juice to be free from it?—Yes, I have found some lime juice to be quite free from it.

3831. From which you infer that its use is not necessary?—Yes. There is then the question of formaldehyde, which I might perhaps refer to now conveniently to the Committee. I am of opinion that the practice of adding the solution of formaldehyde, known by the name of "formalin," to milk is considerably on the increase. I regard formaldehyde as a dangerous substance. I have carried out a number of experiments with formaldehyde solutions. I submit some of the principal results of those experiments. The conclusion to be drawn from the results of experiments made by myself and others is, broadly speaking, that formaldehyde even in very dilute solutions profoundly affects some of the constituents of food materials in such a way as to render them practically insoluble and incapable of digestion. With regard to the experiments which I have made with formalin they are these. First of all, the action on gelatin of solutions of formalin. It appeared desirable to make some special experiments with small quantities. Shreds of gelatin were soaked in water till soft, and then were placed in solutions made of formalin and water. Formalin, I may explain, is a solution of formaldehyde, in which the formaldehyde is present to the extent of about 40 per cent. Treated with a 0·5 per cent. solution of formalin, a marked effect is produced immediately; the gelatin is rendered absolutely insoluble in boiling water, and becomes hard and horny. This effect is also produced with a 0·1 per cent. solution of formalin. Then I experimented with egg albumen. Fresh egg albumen was treated with a few drops of a 0·5 per cent. solution of the formalin, which converts it into a gelatinous mass insoluble in water. The same effect is produced, of course, in a lesser degree, with a 0·1 per cent. solution of formalin. A series of digestion experiments were made with Armour's pepsin and hydrochloric acid on coagulated and comminuted egg albumen, and also on fibrin.

3832. Were these experiments carried out by yourself?—They were carried out by myself side by side with similar experiments with Armour's pepsin and hydrochloric acid without the presence of formalin. In from two to two and a half hours the mixtures of albumen and pepsin, and of fibrin and pepsin containing no formalin, were practically dissolved; after six hours, in the mixtures containing formalin there was no apparent solution, and an insoluble deposit was found at the bottom of the flasks. There are a number of other experiments which I do not know that I need trouble the Committee with, but the net result is, as I have said in my proof, that formalin appears to have a very powerful action indeed upon casein, rendering it insoluble and indigestible, and upon fibrin and gelatin. I may perhaps say in regard to that, that I am aware that a certain number of statements in the nature of negative evidence have been made and published—perhaps made here also—as to the small effect, or the absence of effect produced by formalin solutions.

3833. On the consumer, you mean?—Yes; and in cases of digestive experiments. I would submit, of course, that negative evidence in a matter of that sort is of incomparably less importance than positive and direct evidence, showing that a definite injurious effect or retarding effect, so far as digestion is concerned, is produced.

3834. So far as I have followed your figures the formalin solution which you applied to food was a much stronger solution than any that could be used as a preservative?—The amount that has been recommended as a preservative is 1 in 10,000. That, I think, is the amount which is or was recommended by the people who are interested in the sale of formalin solutions. I have not made experiments with 1 in 50,000, but I have made experiments with 1 in 10,000, and the effects I have referred to were unquestionably produced by solutions of 1 in 10,000.

3835. (*Professor Thorpe.*) And that is the amount recommended by the persons interested in the sale of formalin as being necessary, you say?—It was at that time; it is possible it has been altered since, but at the time I made these experiments, some three or four years ago, that was the amount recommended. There was a case in which a large company were accused of selling poison in their milk—formalin having been found in the milk, I think, by Dr. Rideal. I was concerned in the case on behalf of the paper that had stated that this company had been guilty of putting poison into their milk, and Dr. Rideal was too. At that time it was stated that the amount recommended was 1 in 10,000. That is perhaps four years ago, but I have not the exact date.

3836. Have you reason to believe the company has altered their suggestion as to the amount?—The Formalin Company? I think not; except from what I hear to-day that Dr. Rideal, who I know is well acquainted with that subject, has said that 1 in 50,000, as I understand, is the amount recommended.

3837. (*Chairman.*) Have you found milk treated with formaldehyde in a higher proportion than one in 10,000, or in as high a proportion as one in 10,000?—I have made no determinations of the quantities of formaldehyde in samples of milk submitted to me for analysis as yet, because there is no satisfactory process of estimation at present. I am myself engaged in endeavouring to work out a process, although I was very much in hopes—if Dr. Thorpe will allow me to say so—that he would have done it first. At present I have not got a satisfactory and certain process for the estimation of the quantity of formaldehyde. I believe we shall be able to get at it, but I have not determined it for that reason.

Major C. E. Cassal, F.I.C.

15 Jan. 1900.

3838. Have you anything to tell us about colouring matters?—Yes; with reference to colouring matters, there are considerable difficulties attaching to this question in consequence of the fact that there are many cases of colouring which may be looked upon as to a certain extent legitimate, either on account of long custom or on account of what may be called "trade continuity." For instance, the colouring of genuine butter with a small amount of a colouring material, known to be uninjurious, can hardly be regarded as objectionable, but the colouring of margarine in order to make it appear like genuine butter is an obvious fraud.

3839. Why is it more an obvious fraud to colour margarine to look like butter than to colour white, and presumably inferior, butter to look like milch-coloured butter?—I do not think because a butter is white it can be held to be inferior, if you will pardon my saying so.

3840. No, and I would not go so far as that, but colour is a sign of quality in butter in many instances, is it not?—I do not actually know that any definite conclusion can be drawn from colour, so far as quality is concerned.

3841. I will put it in this way—it is taken by the public to indicate a rich butter, is it not?—Very possibly that is so, but, of course, the practice of colouring butter with an innocuous colouring matter is a very old one, and it would come under what may be called the trade continuity protection, perhaps; whereas in the case of the colouring of margarine there could be but one principal object in colouring margarine like butter, that is to make it appear to be butter.

3842. Do not understand me to defend it, I only do not quite see the difference?—Quite so, the colouring of cheese with an innocuous substance may also be looked upon as legitimate, but the colouring of milk to give the impression to the purchaser that the milk is richer in cream than it really is is another plain example of fraud.

3843. There you draw a distinction between milk and butter which seems rather a fine one?—A good colour to butter may perhaps be an advantage in the trade, but I do not know that the public really draw any specific conclusions as to the superior quality of the butter from its colour; whereas, in the case of milk, the addition of a small quantity of aniline dye to milk, which is a practice that appears to be fairly common, gives an appearance of richness to the milk which deceives, or is intended at any rate, to deceive the purchaser. I, from time to time, find that some of the milks submitted to me have been coloured with small quantities of dye, giving a sort of rich, yellowish appearance to the milk.

3844. An aniline dye?—It is an aniline dye, no doubt. The colouring of beet sugar crystals to imitate genuine cane sugar or so-called Demerara sugar is another example of a practice which has been extensively followed, and which serves the purposes of fraud. Colouring with substances which are known to be injurious in themselves, or in regard to the injuriousness of which there is doubt, should be absolutely prohibited; cases in point are—the colouring of preserved vegetables with sulphate of copper and the colouring of sweets with ferruginous earthy matters, and with aniline dyes of inferior manufacture. I can submit examples taken from my reports with statements of amounts in certain cases. Those I shall be able to put in. The first relates to the presence of sulphate of copper in peas. There are six examples which I will put before the Committee, of preserved peas in which copper was found, and in which the percentage of copper on the sample as submitted is given—the copper in grains per lb. and the sulphate of copper in grains per lb., and also the percentage of copper and the copper in grains per lb. on the desiccated sample.

3845. Is the colouring with sulphate of copper a desirable practice, do you think?—I think, as I have just stated, that it is a practice which should be prohibited altogether.

3846. Trade continuity notwithstanding?—Trade continuity notwithstanding. That is, of course, colouring with a substance which is known in itself to be poisonous; and the trade continuity argument, of course, should only be allowed to apply to substances which are known to be innocuous. Then there are also some cases of colouring sweets with oxide of iron added in the form of an earth—an earth rich in iron.

3847. Would that be in considerable quantities?—The quantity is not so very great. I can give the quantities to the Committee; I have them in print, and can put that information in as a paper if you desire it. I may quote from my report to my Authority that "the Medical Officer of Health for the district, Dr. Corfield, having been consulted

Major C. E. Cassal, F.I.C.

15 Jan. 1900.

prior to the institution of proceedings against the vendor of Sample A, which contained 0·806 per cent. of ferruginous earthy matter insoluble in water, of which 42·18 per cent. consisted of oxide of iron, which means 0·34 per cent. of oxide of iron in the sweets, the Medical Officer of Health adopted the view that the oxide of iron present in the amount certified, through its medicinal action, is objectionable for a healthy person, and may be injurious, especially to young children, if not taken under medical direction." Another case, the case of colouring sweets with charcoal, which is a matter of very minor importance, I think perhaps might be mentioned to the Committee. I have here some specimens of silk which have been dyed with colouring matters obtained from the beet sugar crystals which are made up to imitate Demerara sugar, and I have also here two examples of dye obtained from sweets where the amount of dye was very large and quite enough to dye the infant—in fact, all the way inside, I should think—which perhaps the Committee might wish to see (*handing in samples*). The first three are cases of dyed floss silk, the dye having been obtained from samples of sugar; and there is a piece of undyed silk beside them. The next specimens are cases of dye from sweets, the original sample of which I have here (*handing in a bottle of sweets*), the red dye having been obtained from the red sweets and the violet from the violet sweets. I am not, of course, prepared to say that those dyes are injurious. The amount present even in the case of the sweets would be very small. The question of injuriousness is a matter which at present is undetermined.

3848. Do you know the nature of these dyes; are they aniline?—They are aniline dyes, undoubtedly. I am not prepared to say what they are beyond this. One of them is a dye which is known as phosphine, and, I think, I have labelled as phosphine dye on my specimen. That is capable of recognition, but in the very small quantities in which these dyes are present in the case of the sugar crystals it is practically impossible to arrive at any conclusion as to what the exact dye is. Some years ago when this matter was first called attention to—I believe it was first called attention to by myself, but I do not know that there is any honour in claiming priority in a matter of that sort—the dye that was used for colouring the beet sugar crystals to imitate Demerara was one that was detected with comparative ease, because the yellow dye became a beautiful pink on treatment with an acid, so that there was no difficulty about its detection. The manufacturers, however, having found that this was too easily detected, gave up the use of the dye—probably one of the so-called tropeolins—which gave this easy reaction and substituted other dyes, which are not so easily found, and which, in fact, in most cases can only be found with certainty by the application of the dyeing test to silk.

3849. What is the natural colouring matter in Demerara sugar?—The natural colour, I take it, of genuine brown Demerara sugar is caramel, which may be regarded as a sugar itself; it is, at any rate, a near product of sugar. Anything else but caramel ought not to be present in the sugar.

3850. And caramel has no dyeing property?—Caramel will give a tinge to silk, but will not dye it if the test is properly done. It will make it appear dirty, but it will not dye it. With regard to sugar there are some remarks which I might quote from one of my Kensington reports if you will permit me. On a particular occasion "seven samples were certified as adulterated, having been prepared by dyeing colourless sugar crystals yellow, with an artificial organic colouring matter not natural to sugar. They consisted of sugar crystals which had been dyed of a bright yellow colour by means of artificial organic colouring matters belonging to the class of so-called aniline dyes. It is evident that great quantities of the dyed sugars are sold in London and elsewhere. Purchasers are under the impression that they are being supplied with genuine cane sugar (such as "Demerara"), whereas they are in reality getting sugar crystals which have been artificially dyed. In this way beetroot sugar is coloured and sold as "Demerara," a natural product having been tampered with by admixture with an artificial dye. Whatever the real object may have been in the preparation of these sugars, it is obvious that the proceeding enables one article to be substituted for another. The dyeing materials used belong to a class of substances which are chemically of a very complicated character. Some of them are known to be of a poisonous nature, while the action of others, when ingested, is unknown, while others, again, are asserted upon insufficient and unsatisfactory evidence to be non-poisonous. Apart, therefore, from other considerations, these cases afford an illustration of the impropriety of tampering in such a way with articles of food, without, at least, an open statement of what has been done. Although in dyeing an article of food, the weight of the dye-stuff used must be exceedingly small as compared with the weight of the substance dyed, it must be admitted that the proper course of action in the present state of knowledge on the subject is, as far as possible, to prevent the use of dye-stuffs of the general character indicated for colouring articles of food, in view of probable abuse; and the public have every right to expect that natural food-products shall not be coloured with aniline derived dyes." I have one other thing with regard to butter on which you asked me just now. I might mention in addition to what I have said about butter, that I have taken out the figures for 1898 and 1899 as to the samples of butter containing boracic acid submitted in one of my districts. In 1899, out of 67 samples submitted, 47 contained boracic acid equal to 70·14 per cent; in 1898, when only a few samples were taken in that district (only 9), three contained boracic acid, which is equal to 33 per cent. In another district in 1899, of 64 samples of butter taken 42 contained boracic acid, which is equal to 65·62 per cent., and in 1898 in the same district of 50 samples taken 27 contained boracic acid, which is equal to 53 per cent.

3851. Were these samples of fresh butter with no salt?—I do not know that; they were simply samples of butter submitted in the ordinary way under the Act, they were samples purchased as butter.

3852. (*Professor Thorpe.*) Many of which turned out to be margarine, I suppose?—No, those are samples of butter not otherwise adulterated. But it is a very common thing to find boracic acid in mixtures of margarine and butter, and a very common thing to find it in margarine itself. There is that case to which you referred—the clotted cream case which has now gone to appeal. I have here a statement with regard to that. I believe that the matter has been referred to before your Committee, and it may perhaps be as well to mention it because it is a case in which apparently all the evidence that could be brought to bear on behalf of the defence was brought to bear. I understand that one of the witnesses who has given evidence before you stated as much to the Committee, namely, that every effort was being made by the defendants to carry this case "to a successful issue" for the defence. I have here an extract from my report to the parish of St. George's, Hanover Square, which is just published upon that case. That was a case of clotted cream containing 0·464 per cent. of crystallised boracic acid (H_3BO_3). There is no doubt that the defence did their utmost to carry the case to what they regarded as a successful issue.

3853. Do I understand that this case is still *sub judice*?—A fine was inflicted, there was a conviction, but we have since been informed that the defendants intend to appeal. I mention it because you referred to it just now, and because I understand that it has already been referred to at some length before your Committee. My report says, "The case was strongly contested, and occupied the attention of the magistrate (Mr. Sheil) on three occasions, a number of medical and other witnesses having been called on behalf of the defendants. Evidence was given in support of the vestry's case by the Medical Officer of Health (Dr. Corfield); by Dr. J. Charles Jackson, Medical Officer of Health for Fulham; by Dr. Alfred Hill, Medical Officer of Health for Birmingham; by Dr. Allan, Medical Officer of Health for the Strand District; and by myself. Evidence supporting the vestry's case was also given by Mr. H. Droop Richmond, analyst to the Aylesbury Dairy Company, who was present on subpœna. Since the hearing of the case the defendants have given notice that they intend to appeal."

3854. I think this will hardly help us much?—That is all; but I thought you would wish to have that. I thought you asked me whether there was a conviction in that case. There was a conviction after this hearing I mean, and the defendants were fined £10 and thirty guineas costs.

3855. (*Dr. Bulstrode.*) You are, I think, opposed to the use of any preservative at all, other than common salt?—Yes, I am.

3856. Are you opposed to saltpetre, too?—Yes, I am opposed to saltpetre also.

3857. (*Chairman.*) How about "trade continuity" in saltpetre?—In that case "trade continuity" is a factor, Major C. E. Cassal, F.I.C.

15 Jan. 1900.

but then, of course, saltpetre is a thing that ought not to be used.

3858. (*Dr. Bulstrode.*) You think that supposing all preservatives cannot immediately be done away with their nature should be stated. Is that your position?—Certainly; if they cannot be done away with, then a full and very clear statement of the nature of the preservative and its amount should be given to the purchaser.

3859. And also, I think, you say their probable effect?—And their probable effects.

3860. Would that not be rather difficult in some cases?—Since the people who use these things and advocate their use assert that there is no harm whatever attaching to them, they have no doubt got good grounds to go upon, and I suggest that they should give those grounds.

3861. On the label?—On the label.

3862. Do you think that actual cold storage is necessary in order that milk may be supplied without any preservative?—Cold storage I think appears to be necessary in very hot weather, but cold treatment immediately after the milk is drawn appears to be sufficient under all ordinary circumstances.

3863. We have had it raised as an objection to the cold treatment immediately after drawing the milk, that many farms are not supplied with a proper water supply. Would you regard that as a reason for allowing the use of preservatives?—Certainly not. I think that in the first place, if I may say so, one of the very first essentials of a farm that supplies milk is that it should have a proper water supply. Large dealers and large companies now insist upon their farmers having a proper water supply, and I am told further that there is no real practical difficulty against farmers providing themselves with the apparatus for cold treatment.

3864. It is actually illegal under the Dairies, Cowsheds, and Milk Shops Order, to have a cow shed or a dairy without a proper water supply, is it not?—I am not familiar with the Act; but I believe that it is so.

3865. We have had it in evidence that as much as 80 grains of boracic acid have been found in a pint of milk; that is in excess of anything you have found, I gather?—I have had as much as 100 grains per gallon, but that which you mention is rather more, of course. I may perhaps say that the estimation of boracic acid until recently has not been a very easy matter.

3866. Would you say that there would be a difficulty in defining the amount both of boracic acid and formaldehyde, owing to the difficulty of accurately estimating those amounts?—Not so far as boracic acid is concerned. Boracic acid now can be estimated very fairly accurately. I have no difficulty in doing it; but it is a process which requires considerable care. As for formaldehyde, I have already stated that we are not yet in possession—at least I am not yet in possession of a process which I regard as sufficiently accurate to enable me to certify under the Act.

3867. Therefore you do not think a suggestion, which I daresay you are familiar with, made by Dr. Rideal and Dr. Foulerton, that 1 in 50,000 should be used, would be easy to carry out in practice?—Do you mean to detect 1 in 50,000?

3868. Yes?—I think you can detect it; there is no difficulty about detecting it qualitatively.

3869. Quantitatively?—To determine it quantitatively is a matter upon which I am not yet prepared to make a definite statement, but I have little doubt that one would be able to determine the quantity also, probably by a colour process.

3870. You know this paper by Dr. Oscar Liebreich, I expect (*showing pamphlet to witness*)?—I have had it sent to me, but I have not read it yet.

3871. He makes this statement: "On the other hand it has been pointed out that the method for the chemical quantitative analysis of boric acid is far from perfect. This must be conceded"?—I do not concede it at all. I should never have gone into court on these cases unless I had got a certificate based on an anlysis which was absolutely satisfactory. I may perhaps add that in order to satisfy oneself on a point of that sort you must make a number of blank experiments, adding a certain definite amount of boracic acid to samples of milk, and finding it again within certain limits of error; and until you have done that you have not got a satisfactory process. But I have done that, and therefore my process is, I think, satisfactory.

3872. (*Dr. Tunnicliffe.*) I should like to ask you a question with regard to a statement of yours to this effect —you say that if a chemical preservative is present in food in sufficient amount to exert a specific effect on that food that fact of itself is sufficient to show that the ingestion of food by the consumer must be injuriously affected; would you give the Committee some of the steps of the reasoning which has led you to that conclusion?—If a chemical is capable of producing an antiseptic effect, that is, of preventing the decomposition of the food, which decomposition it must go through during the process of digestion, it plainly must arrest the action of the process of digestion upon the portion of the food which contains the preservative. That is on theoretical grounds, and one would expect that it would be so; but there are definite experiments which give positive evidence upon the point. Dr. Rideal, for instance, has shown the retarding effect of formaldehyde solutions on the digestion of milk—I think it was. My own experiments which I quoted just now, have shown the effects of formaldehyde also, and although it is true that experiments carried on outside the body are not, of course, the same as experiments carried on within it, there are a number of experiments which have been carried out, and I believe you have had them before the Committee, upon animals, which have shown the retarding effect of preservative chemicals. I do not know whether I have quite answered your question.

3873. This is the point I should like to put to you: do you think it is possible to add formaldehyde in such proportion as, while sufficient to ensure its preservative effect, will be incapable of exerting an action upon digestion?—No, I do not think it is possible, because so long as it is present in sufficient amount to prevent the action of the digestion process, or to retard the action of the digestion process—and if it preserves the milk it must be present in such an amount—then the digestion process is injuriously affected.

3874. Would it not be possible to add it to such an extent that it would inhibit the growth of the organisms causing decomposition, but at the same time would not inhibit the action of the enzymes causing digestion?—That may be a matter of experiment, but I should be disposed to think not, because after all the process of digestion is a process very similar to the process of decomposition by organisms which the preservative is added to prevent.

3875. With regard to your experiments with formic aldehyde, are you aware of the fact that milk containing 1 in 10,000 of formic aldehyde is practically undrinkable? —No, I am not. I think that 1 part in 10,000 is a very small amount; it would be objectionable to drink it from my point of view. Do you say it is undrinkable on account of the taste?

3876. It is undrinkable from the point of view of taste? —I do not think so. I do not think it would be tasted. Of course it is not 1 part in 10,000 of formaldehyde; it is 1 part in 10,000 of formalin, which is a 40 per cent. solution of formaldehyde.

3877. You can take it from me that you would taste that?—I do not think so, but I will not assert the contrary; I have not noticed the taste when I have tried it.*

3878. (*Professor Thorpe.*) The only question that I wish to ask you about is from the very practical point of view of the working of the Food and Drugs Act. Assuming that the Committee came to the conclusion to recommend, and it became law eventually, that preservatives should be declared, would the proviso that also the amount should be stated prove a difficulty in working the Act?—Yes, I should think that would be so, because cases would then probably largely go upon whether the quantity stated by the public analyst was or was not correct, and there might be—if I gather that to be the trend of your question—a good deal of trouble in regard to that and expense on both sides, in all probability in regard to expert evidence.

3879. Now, although it is, as you say, a matter of comparative ease to determine approximately the amount of boracic acid, the determinations have not that rigorous accuracy which many quantitative determinations made in connection with the Act possess, I believe?—I should say they have quite enough accuracy for the purposes of the

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* *Note by Witness.*—In view of the very powerful effect produced when the formalin is present in the proportion of one part in 10,000, I consider that its use in the proportion of one in 50,000 would still be most objectionable. The reduction of the proportion to this extent is of no great significance.

Major C. E. Cassal, F.I.C.

15 Jan. 1900.

Act, which are not, of course, processes of a kind, as I need not tell you, which can be compared with the stringent gravimetric processes in mineral analysis. That, of course, is the case. But at the same time one gets what we should professionally call very good results if the boric acid estimations are carried out carefully. I admit that it is a troublesome thing, but I have found that I get very satisfactory results; I mean the error from the point of view of the Act is not of any importance at all. If the process is worked properly I should expect another analyst working on the same sample to come very close—quite close enough for the purposes of the Acts.

3880. But the difficulty arises at once when a limiting value is insisted upon?—Yes.

3881. And the court would probably be hampered by a conflict of evidence?—Yes, I think that is very likely, in fact there is no doubt that that would be so, but then that has always been the case in all these questions involving food analysis. It was, of course, the case with milk and the case with butter, and it is so still. Considerable differences of opinion may certainly arise. I am bound to admit that in the case of the determination of boracic acid we should, at any rate, at first meet with a good deal of difference of opinion. In a case of my own the other day, in which a sample of milk was analysed by another public analyst, the defence informed me that I was quite wrong, and that my colleague had got very different results. I was shown a copy of the certificate, and the results had been miscalculated by the legal gentlemen concerned. From the results given in the certificate it appeared that my colleague had found twice the amount of boracic acid that I had found. I need hardly say that that evidence was not produced on behalf of the defence.

3882. You have not exactly struck the point I mean. Of course, there are conflicts of opinion in regard to food and drug cases, but this conflict of discussion really does not matter to the Bench when it relates to whether a sample of milk was adulterated with 12 per cent. of water or 10 per cent. of water?—Quite so.

3883. It is the fact of the adulteration to the prejudice of the consumer which is the material point?—Quite so.

3884. Therefore a discrepancy of that kind between individual analysts does not very much matter, but when individual analysts differ as to when they arrive at a limiting value, it might entirely upset the case?—It would there is no doubt, be a matter of considerable difficulty, I quite agree.

3885. Therefore you think it would be extremely difficult in many cases to get a conviction if a limiting value in this way were insisted upon?—I certainly quite agree that the difficulty of getting convictions would probably be considerably increased.

3886. That is the case with boric acid?—Yes, I think so.

3887. In the case of formalin your experience as an analyst, I suppose, would teach you that the difficulty there would be still greater?—Undoubtedly.

3888. Why would it be still greater?—Because formaldehyde, as I need hardly say, is a very awkward thing to deal with. It is a gas in solution, and the only method which appears to promise any satisfactory result for the purposes of determination in such an article as milk is a method which would be based upon a colour reaction, and not, as in the case of boracic acid, either upon a direct weighing of the substance separated on a titration figure; and, of course, in cases of colour reactions there is always a possibility of considerable difficulties arising.

3889. There is a further difficulty, is there not, as regards formaldehyde that it is a substance which is liable to polymeric change?—That is so.

3890. And therefore a method which would enable you to detect it in one case need not necessarily enable you to detect it, much less quantitatively estimate it, in another?—That is so.

3891. That is an additional difficulty there?—Yes, that is an additional difficulty.

3892. It is also true, is it not, that formaldehyde is a very reactive substance?—It is, very.

3893. There is some ground for belief that it acts chemically upon the casein, for example, in the milk?—I think there is no doubt about it.

3894. And it disappears, therefore?—To a certain extent it enters into some form of combination, no doubt with the casein.

3895. Therefore a milk vendor might in good faith only add the legal limit, or he might indeed, in bad faith, very much increase the legal limit, and it would not be possible by any known method to substantiate how much he did add? How much he orginally added?—Certainly not.

3896. (*Chairman.*) Have there been any experiments on the absorption of formaldehyde by the casein?—Yes. You could not, as a matter of fact, I quite agree, find the original amount of formalin added so far as we at present know. That no doubt is the case.

3897. (*Professor Thorpe.*) Therefore it would make the practical carrying out of any suggestion as to the definition of amounts or the limitation of amounts a very difficult thing to effect?—It would be a very difficult thing in regard to the amounts originally added. Of course, in the case of formalin you might limit possibly the amount of detectable formaldehyde.

3898. But the ambiguity surrounding the whole business would be such that it would be extremely difficult to gain convictions in a court of law?—It would increase the difficulty very considerably, especially in the case of formaldehyde, undoubtedly.

Mr. A. J. de Hailes, F.I.C.

Mr. Alfred James de Hailes, F.I.C., called; and Examined.

3899. (*Chairman.*) You are analyst to the Dairy Trade Protection Society?—I am.

3900. And you represent them before this Committee?—Yes.

3901. In the first place, you are an analyst of considerable standing—20 years, I think?—Yes; I am.

3902. And a Fellow of the Institute of Chemistry and other learned societies?—Yes.

3903. I think you are prepared to speak from an extended experience as to the presence of preservatives in dairy produce, and the necessity or otherwise for their use?—Yes. The first thing I should like to draw the Committee's attention to is the times of arrival of the milk trains in London. Leaving out of account the trains that only draw from a short distance, the long journey trains are practically recognised as two every day. The London and South Western Railway, for instance, has a recognised milk train arriving at Waterloo, or supposed to arrive at Waterloo, at 10.43 in the morning; but I find, as a matter of fact, it generally does not arrive till a quarter past 11.

3904. Is that with the morning's milk?—That is with the morning's milk. The other recognised milk train on that line is timed to arrive at 12.35 a.m. in the middle of the night; but that usually arrives at half-past one; that is, with the afternoon's milking.

3905. Those are both long-distance trains?—Yes, exactly so. Of course, there are a great many other trains that bring milk; but these are the recognised milk trains, and they bring milk from long distances.

3906. Outside what radius?—I do not know that I could exactly say how far.

3907. Approximately, what do you call a long distance?—I should say 50 or 60 miles is the extent of the local traffic. No doubt, these long journey trains pick up milk all the way up the line as well; they bring it from a distance, and they also have churns put on at intermediate stations. The same remark practically applies to all the lines delivering into London. I have the times of all the trains here, and to save time I might say that it practically comes to the same thing, namely, one recognised train in the morning, and one recognised train in the middle of the night. There are a great many other trains that are bringing milk; but the recognised trains seem to me to be practically two for each line of railway. The morning trains naturally bring the morning's milking and the midnight trains also bring the afternoon's milking. If you notice the time at which the morning's milk arrives in London, you will see it is too late for the morning's delivery in London, and it necessarily has to wait over for the afternoon; but the cows give much more milk in the morning than they do in the afternoon, whereas less milk is required in the afternoon than in the morning, and consequently a good deal of that milk is kept over until the following day. Sometimes it is kept at the country end of the line, and sometimes it is kept here in London at the stations by the wholesale dealers, so that the milk is frequently 24 hours old before it is served out to the customers at all. The same remark applies to the afternoon's milk. That comes up in the middle of the night, and clearly that is not wanted then, and it cannot be used till the following morning. It is then 24 hours old and upwards before it is delivered to the consumers.

3908. I do not quite follow that?—The milk is milked in the afternoon—I cannot give you the exact time; about four o'clock in the afternoon—I mean the long journey milk.

3909. In summer?—Yes.

3910. At four o'clock?—Yes, and it arrives in London about midnight.

3911. How often do they milk the cows in summer?—Twice a day.

3912. And the last time is four o'clock in the afternoon?—I would not like to say the exact hour it is milked at; sometimes it is four, and some farmers will milk earlier. In the country generally the cows are milked only twice a day—in the morning and the afternoon. That afternoon's milk, milked, say, at four o'clock, arrives in London at midnight or about midnight; it cannot be used till the next morning. It may be taken from the stations, or it may be left at the stations. I may say that I have a man who is going round the stations constantly collecting samples of milk from farmers, and he is always employed at that. That milk goes out, perhaps, on the dairyman's six o'clock round, when it is 24 hours old.

3913. How is that? You say it is milked in the afternoon at four o'clock, and it is delivered at six o'clock the next morning?—I beg your pardon. It is 12 hours old, I should have said, of course. But with the morning's milk it is milked early in the morning—I think I have made myself clear there—and it is frequently 24 hours old before it is delivered to the consumers.

3914. What do you deduce from that?—Simply as I say in my proof of evidence that there is need for keeping milk from 24 to 36 hours old. When a customer gets his milk he does not know that it is 24 hours old, and the milk must certainly be prepared to stand 12 hours with him. It is not all consumed the moment he receives it.

3915. I ask again what do you deduce from that?—That some method of preserving milk must take place.

3916. What is that method to be?—As the lesser of two evils, multiplied micro-organisms or the presence of a preservative, I consider that a boron-base preservative is the safest and the best thing that is in the market.

3917. What is the method now in regard to the milk supply of London?—In some cases the milk is cooled. Cold storage is employed, and unquestionably that will keep milk fresh for a considerable time. I know of a case where milk is cooled down to 40 degrees, and it arrives in London only a few degrees higher than that, and that certainly will keep it; but those who have not cold storage and who cannot apply cold storage, who have not cold water even—and there are many farmers in this country who have not cold water—cannot possibly cool their milk below 60 degrees.

3918. What business have they to have a dairy, then, if they have no cold water?—Our farmers throughout the country have certainly not all got cold water.

3919. Are there not certain provisions that they have to comply with?—I am not aware of it.

3920. Not in regard to their milk supply?—I am not aware of any.

3921. You have never heard of any?—No.

3922. As a matter of fact, a great deal of the milk trade of London is carried on without preservatives, is it not?—Yes, there is some unquestionably carried on without a preservative.

3923. I asked you if there was a great deal?—My experience would lead me to believe that there is an enormous amount of preservative used and far more than anyone has any conception of.

3924. Would you say that 50 per cent. of the milk which comes to London contains no preservative?—It may do.

3925. But you cannot say?—I could not say that.

3926. You do not know that?—I know there are some milkmen who make a strong point of not using preservative, and who are very careful to draw their milk from local sources quite near London; the difficulty is when we come to the long journey trains; milk a long distance away from London has got to be kept for from twenty-four to thirty-six hours.

Mr. A. J. de Hailes, F.I.C.

15 Jan. 1900.

3927. What would you call a short distance from London?—Forty miles, or something of that sort. Milk will keep naturally sometimes for a longer time than twelve hours.

3928. Would you go as far as to say that it is impossible to supply milk to London from a greater distance than forty miles without the use of preservatives?—I would not exactly like to say that; I would say this unhesitatingly, that the milk trade as it is at present carried on cannot be carried on without the use of preservatives.

3929. Would that not be an effective objection to every reform, that the thing could not be carried on as it is at present?—Yes, I quite see the point.

3930. What are the chief preservatives used?—Formalin, that is to say a 40 per cent. solution of formaldehyde and boron base preservatives.

3931. Which of these are most general in your experience?—Until comparatively recently boron-base preservatives have been used, but somewhat recently formic aldehyde has come into use. I do not know that I can say to what extent it is used, but it certainly is very much in favour with the milk trade, on account of its being so easily applied.

3932. Would you see any objection to making a declaration necessary on the part of the purveyor?—Yes. I see very grave objection to it. I think it is an impossibility if one considers the way in which the Food and Drugs Act is carried out. One could hardly expect the vendor of a small quantity of milk to a child, for instance, to tell that child over the counter that the milk is preserved milk. The way the Food and Drugs Act is carried out in the present day is mostly this: An inspector does not call himself, but sends someone as a kind of a trap into a little shop in London—a girl perhaps will be sent in, and she will ask for probably half a pint of milk. It is bought; the vendor has no idea, of course, that it is going to be analysed; but then when the purchase is completed, in steps the inspector and says, "This has been bought for the purpose of analysis by the public analyst."

3933. On behalf of the Dairy Trade Protection Society, would you object to any declaration being exacted from the vendor?—Yes.

3934. On the ground that it is impossible?—It is impossible, I think. I do not see how you can possibly label all milk.

3935. You said it was impossible. Are you going to modify that?—No, I think it is impossible.

3936. Has it been found impossible in other countries?—I do not know to what extent the declaration is made in other countries; but it is not allowed, I believe.

3937. Are you aware of the system of declaration in the United States?—No.

3938. Then, when you say that it is impossible it is pure matter of speculation there?—I mean this: If, of course, a notice in the shop would convey to all the purchasers that the milk was preserved, if that was accounted sufficient, then it would be possible; but if the vendor is to tell every person who comes in that the milk is not sold as fresh, but as preserved, and he will have always to do that, because he will never be sure that it was not preserved—it becomes an impossibility; it becomes impracticable, that is to say.

3939. But suppose it were made an offence to sell milk which is not fresh under the name of fresh milk, would you consider there would be any injustice in that?—I think it would be very hard indeed; it would create a monopoly.

3940. Do you think it would be hard upon the vendors?—Yes; all those suppliers of milk who have got milk from near London could do it, but those who have to draw from a long distance away could not do it.

3941. The same would not apply to the butter trade, I suppose; you would not object to a declaration there?—Yes, I think it would be extremely difficult. The same thing would occur there. Is the vendor to tell every customer that his butter contains a preservative?

3942-43. What I mean is that he would not be allowed to sell as fresh butter what was preserved butter, and he would have to sell things under their right name?—I feel very strongly about the want of justice that

Mr. A. J. de Hailes, F.I.C.

Jan. 1900.

often takes place in these cases, simply through a person forgetting, omitting to state something that the law says he ought to state. It becomes impracticable in that way; it cannot be done.

3944. Then do I understand that the Dairy Trade Protection Society is rather an association of small traders than of large traders?—No, I do not think we can say that. There are a good many large traders belonging to it, as well as small ones; there are wholesale men, and there are small shopkeepers belonging to it, too.

3945. Therefore you do not hold a brief specially for the small trader?—Oh, dear no. I rather like to work it down and see how it affects them.

3946. But you recognise, do you not, that under modern conditions there is always a tendency to crush out the small trader?—Yes.

3947. When a trade becomes organised?—Yes.

3948. Whether in the interests of the trade or in the interests of the community?—Yes. I have been told of some farmers who send up their milk only once a day through both summer and winter, and the reason for that is that they live at such a long distance from the stations that it would be impossible for them to sell the milk at the price at which they do unless they did so, as they would have to keep horses especially to drive their milk to the stations. I believe that is the case with many of the farmers on the North Staffordshire line.

3949. (*Professor Thorpe.*) You think that that is a sufficient reason—because a man has a certain inconvenience in getting his milk to a station, therefore he should necessarily be permitted to put chemical preservatives in it?—No; I do not think that is a sufficient reason, but it is a way out of a difficulty.

3950. Are you not aware that very large organisations in London deliver milk here without any preservatives?—Yes, they have cold storage.

3951. You say one difficulty is the practical impossibility of many farms getting a sufficient supply of cold water?—Sufficiently cold to cool the milk for preserving purposes.

3952. A sufficient supply of cold water, I said?—Yes.

3953. There is a practical difficulty about that?—There is a practical difficulty.

3954. Is it a proper condition of things that a dairy should not have the means of a sufficient supply of cold water?—One would like to see them have cold water, but I have been asked again and again by men who have come to me and said: "What can we do; we have not cold water, what are we to use for keeping our milk?"

3955. That is to say, they have no water at all, or very little?—They have water, but it is not cold water.

3956. Have they no means of cooling it?—I should think not.

3957. Does it not occur to you that there is machinery now of a comparatively cheap kind which would enable them to cool any amount of water that is necessary?—Yes; but we are dealing with people who have not large sums of money to expend on cooling machinery.

3958. You are dealing in fact with a trader who, because he must apparently exist, must do his business in a manner which is not altogether to the benefit of the community?—No, we are dealing with the farmer at this moment.

3959. We are dealing with the trader; he is a trader, he is a milk vendor who is doing his work under conditions which are not on the whole to the benefit of the community; he is short of water, and he is short of the means of cooling it; is that so?—That is so.

3960. Is that a condition of things which you would say ought to go on?—No; if one could see some practical remedy for it.

3961. There are no practical remedies that you are aware of to meet such a condition of things?—No, I should suggest the use of a preservative.

3962. That is the only practical remedy that you can suggest?—As a cheap method.

3963. As a cheap method?—Apart from the question of cheapness?—If the question of price does not come in, of course if the Government are going to lay down the plant, then it is another matter.

3964. You say in your *précis* that pasteurised or sterilised milk cannot be regarded as fresh milk. Is that so?—Yes. I do not regard it as fresh milk.

3965. But would you regard milk containing preservatives as fresh milk?—Yes, I should.

3966. Now, why draw that distinction?—I consider that the milk has undergone a distinct change by sterilisation; it is no longer what it was originally; whereas if —perhaps I ought to draw the line here—I do not approve of the use of formic aldehyde.

3967. Why? That, I understand, from your showing, is used by your clients to a greater extent than any other? —They do use it, and they are annoyed with me for disapproving of its use. But unfortunately I do disapprove of its use, on account of the effect that I know it has upon the casein of the milk; it hardens the casein.

3968. Therefore, *a fortiori*, still removing it from the category of fresh milk?—Certainly; I would not use it at all; I would prohibit the use of formic aldehyde.

3969. Then a vendor who is selling a milk charged with formic aldehyde is selling something to the prejudice of the consumer?—I consider that he is.

3970. Therefore an action would lie upon him under that particular count of the Act?—I think so. With regard to the boron-base preservative I can detect no change whatever in the milk.

3971. You would still regard it as fresh milk?—I should regard it as fresh milk; in fact it is the lesser of two evils. If one has milk without a preservative anyone is obliged to have milk that contains an enormous increase of microbes; and I consider a preservative the lesser of the two evils. I would rather partake myself of milk containing a preservative than of milk which is on the way towards being sour. One or the other we must have

3972. (*Chairman.*) Or sterilisation?—Sterilisation alters the character of the milk.

3973. (*Professor Thorpe.*) How about the microbes in Pasteurisation and sterilisation?—Undoubtedly you have got rid of the microbes, but you have altered the character of the milk.

3974. To what extent?—I think it is very difficult to say. I do not think that we know at the present day to what extent we may have altered the character of the milk. We may have altered the character of the ferments in the milk, and certainly we have driven out all the gases; the cream is no longer in apparently the same condition, and it will not rise for some time as it does in fresh milk.

3975. That may be due to a mere physical alteration in the milk?—It may be, but it may have very grave effects upon the health of invalids.

3976. That is a purely hypothetical statement, is it not, that it has "grave effects." What is the evidence that there are any grave effects arising from sterilised milk?—Pardon me; I did not say "grave effects" arising from the use of sterilised milk. I said if changes have taken place in the milk, which I think is generally accepted is the case in pasteurised and sterilised milk, then may they not produce very grave changes if children and invalids were to be fed on this alone? It has never been tried for any length of time, but on the other hand we have had boric acid preservatives used for the last twenty-five years, and we have not a single case on record of its doing any harm.

3977. I will take you on that point; is it not notorious that there is much greater doubt as to the evil effects of the use of boric acid in milk than there is as to the evil effects of pasteurised or sterilised milk?—I have never heard of any evil effect produced by the taking of boracised milk.

3978. That is not my question?—But I do not remember having heard of sterilised milk or pasteurised milk being used at present for any considerable length of time.

3979. That is not quite an answer to my question; I ask you, is there not notoriously much greater doubt concerning the action of boracised milk than there is as to the evil effect of drinking sterilised or pasteurised milk? —Yes, I think there is a general opinion that certainly boracised milk is objectionable, but to my own mind there is no objection to it, and I never heard of any proof that there was. It seems to me that this is a question that has been raised by one or two people, and a great stir has been made about it; but seeing that it has been in use for a quarter of a century, surely if it is doing such terrible damage as is supposed, why there would have been thousands of cases and hundreds of thousands of cases.

Mr. A. J. de Hailes, F.I.C.

15 Jan. 1906.

There is not a large town in the kingdom that is not being served with boracised milk, and yet we cannot find a single instance where it has done any damage.

3980. That perhaps is open to question, is it not; or do you make that statement as an affirmation?—Yes, I have not heard of any case.

3981. That is your individual opinion?—Yes.

3982. Are you aware that there are already large communities which are exclusively served with sterilised or pasteurised milk?—No, I am not aware of that. I know, of course, that these things are for sale, but I have not heard of their being consumed in large quantities as a regular thing, or of large communities being served with such milk as a regular thing. I know, of course——

3983. (*Chairman.*) Is it worth proceeding to argue about it? Is not the broad fact this: that on the continent milk, as a rule, is drunk cooked or pasteurised, and in this country it is drunk raw?—I believe it is so in Denmark; I believe it is pasteurised in Denmark.

3984. Would you answer my question. Is it not the fact that on the Continent of Europe, from the South of Italy to the North of Denmark at all events, it is the practice to drink milk cooked and not raw?—I was not aware of that. I am told that if preservatives are forbidden in cream it will entirely do away with the cream trade. It would be quite impossible then to sell cream in pots.

3985. Is all the cream that comes to London treated with a preservative?—I believe all of it is that is sold in pots.

3986. (*Professor Thorpe.*) You say in the course of the précis of your evidence that the reason for the prohibition in the case of butter, of preservatives in Denmark, is probably a species of protection. Will you kindly explain what you mean by that?—Yes, I think that we have been making in Ireland butter of increasingly good quality which has been preserved; Denmark has known, I suppose, that we have been cutting their trade very narrowly, and they have been afraid of being ousted altogether; preservatives used to be used in Denmark, and they have forbidden their use. Preservatives are no longer used there, and they are making a bid for our butter trade.

3987. (*Chairman.*) Do you suggest that that was the motive of the Danish Legislature in passing that law?—No, I do not like to say so straight off.

3988. Then what is the use of saying it at all?—I cannot prove that that was the motive, but I think in a great many of these cases, if we look behind them, we shall see that a species of protection has been at the bottom of them. Take, for instance, the Swiss——

3989. I asked you this plain question; do you suggest that the view which you have just mentioned influenced the Danish Legislature in passing that Act?—I think it is quite possible. In Switzerland, if I may put it this way?

3990. Will you answer the question I put. Do you suggest that the motive of the Danish Legislature in passing that Act was as you describe?—I did suggest that, yes.

3991. Is it founded on anything within your own knowledge?—No, not on my own knowledge; but I would like to put it in this way—if we look at Switzerland——

3992. You were talking of Denmark just now. I think we had better keep to it?—Yes.

3993. (*Professor Thorpe.*) Do you wish to tell the Committee that any considerable quantity of Danish butter ever came into this country charged with preservatives?—I have understood so.

3994. Do you know of your own knowledge that it did?—I have been told so.

3995. That is what you have been told?—Yes.

3996. You do not yourself personally know it?—I am not in the butter trade.

3997. But you are a person connected with the Dairy Association, you are an analyst of twenty years' standing, and you are conversant with the analysis of dairy products?—Yes.

3998. Do you mean again to say that relatively large quantities of Danish butter came into this country charged with a boric preservative?—Yes. I am quite certain of it. They were preserved with borax until comparatively quite recently. I believe I am right in saying that in Switzerland the reason for the objection to boracised meats entering into the country had to do with protection. They wished to counteract in some way the way America was treating their imports into the United States. Their imports were embroideries and watches, and there were heavy duties put on them. I understand that the reason why the Swiss people tried to prohibit the entrance of boracised meats was as a countervailing something to make the United States alter their feeling towards Switzerland. Perhaps it is only my own opinion, but with regard to Switzerland I believe that is an absolute statement of fact.

3999. Assuming that that is so, that is not at all relevant to the case of Denmark?—No, it does not actually apply to Denmark, of course; but is it not possible that behind all this movement there is something that has very little to do with the health of the population, and that it is rather the question of the protection of various interests?

4000. (*Chairman.*) Do you think a Legislature would aim at doing an injury to the English trade by prohibiting preservatives in its own produce? I do not quite follow you? (*No answer.*)

4001. (*Dr. Bulstrode.*) I take your opinion to be that the labelling of the meats or the labelling of the substances as containing preservatives would be impracticable?—I think so.

4002. Then if this Committee were to come to the conclusion as the result of the evidence which is put before them by medical men and others that the use of preservatives should either be declared or not allowed at all, as declaration, according to you, is impracticable, the only alternative would be to prohibit them altogether?—I think it would come to exactly the same thing practically.

4003. Do you think you are in possession of sufficient evidence to show that preservatives are necessary both in milk and butter?—Yes, I think so—absolutely necessary.

4004. Are you aware that the milk trade of Birmingham, except 9 per cent. of it, is carried on without preservatives?—It is quite possible; it altogether depends upon the distance that the milk has to be drawn, and the time it has to be kept before it reaches the consumer.

4005. Do you see any difference between the conditions of Birmingham and of other large towns which would make the conditions of Birmingham exceptional?—I should think that Birmingham could get milk a great deal nearer than London is able to do, considering the size of it.

4006. Are you aware that the use of boracic acid is prohibited in Austria?—Yes, I have understood that it is.

4007. Do you think that Vienna might have some difficulty upon your thesis in getting non-preserved milk?—I do not think they would have to go very far, would they?

4008. Take Brussels?—Brussels can certainly get it without going very far afield.

4009. Or certain towns in Switzerland?—I should think they could all get it.

4010. Do you not think we have a very large amount of evidence to show that large communities may be supplied with milk without preservatives?—Yes, I quite believe that they can be if we can only have cold storage, but the milk will no longer keep as it is keeping at the present day—as people are acustomed that it should keep.

4011. Is not the cooling of the milk, immediately after drawing, almost sufficient without cold storage?—No, I do not think it is. Consider the evidence I have brought before you with regard to the time that milk is kept. If milk is kept twenty-four hours it will not keep cool in that way.

4012. How do the Aylesbury Dairy Company manage to carry on their supply without preservatives?—I believe they have cold storage.

4013. Here in London?—Yes.

4014. Are you sure about that, or is it that they only have cold treatment before the milk is sent off from the farms?—I really do not know how the Aylesbury Dairy Company carry on their business.

4015. Before giving an opinion upon this should you not have taken the trouble to ascertain how a large company, reputed to supply a considerable portion of London without preservatives, does it? Would you not consider it desirable to have that taken into consideration? Suppose they do not adopt cold storage, and suppose that they only insist upon cold treatment immediately after drawing the milk—would that not alter your opinion?—I

Mr. A. J. de Hailes, F.I.C.

15 Jan. 1900.

should not believe it was done unless I actually saw that they did not have cold storage, or did not draw from a distance.

4016. Then with regard to butter, do you think it is necessary in butter?—Yes, I consider that it is.

4017. And that, in spite of the fact that more than half of the amount of butter coming into this country is supplied without preservatives?—In Denmark they use no preservative.

4018. And the Danish butter is more than half the total amount of foreign butter introduced into this country, is it not?—Yes.

4019. Still you think it is necessary?—Yes. You cannot possibly get a sample of the Danish butter unless you happen to be in the market the very day it comes in; it is all sold beforehand, as it will not keep.

4020. It has already been kept a considerable time, as is proved by the fact that it is here?—Yes, it will keep for a short time, but it has to be sold out—you cannot store it.

4021. Are you in a position to state that in Denmark they hurry the butter away?—No, I do not know that they do.

4022. Would you be surprised to hear that they keep it for several days, and that they do not hurry it away; and all this without preservatives?—I certainly would believe it if you say so.

4023. Perhaps you will see it shortly in print?—Of course, they pasteurise the butter. I do not know whether you gentlemen happen to know what the taste of pasteurised butter is—it is very different from what one naturally considers fresh butter.

4024. Personally, I eat a large amount of Danish butter, I candidly confess.

4025. (*Chairman.*) Is it not the case that some of the largest creameries in this country use no preservatives in their butter?—I am not aware of that. I think that butter can be made without preservative, but it is a question of the possibility of its keeping.

4026. That is not an answer to my question?—I do not know.

4027. Would you kindly tell us whether you have any list of the traders or companies which form the Dairy Trade Protection Association?—I have not. I believe there are something over 1,000 members.

4028. And there is no list kept?—There is a list undoubtedly.

4029. Could you supply it?—I have no doubt the secretary of the Association could supply you with a list.

4030. Could you obtain it from the secretary of the Association for us?—With pleasure.

4031. Your evidence does not accord with a great deal that has already been put before us on behalf of the dairy traders, and, of course, we should like to know exactly how the opinion is divided?—You see it is difficult. There are plenty of dairy traders who are in a large way of business who have cold storage, and who are against the use of preservatives; there are, on the other hand, many dairymen who have no cold storage, and—I say it from years of experience—men who have come to me and asked me how they can keep their milk, as they cannot keep it; they say they must have a preservative. Theoretically I would myself rather have no preservative, but as a practical thing it is the lesser of two evils.

4032. (*Professor Thorpe.*) But you say that you do not hold a brief for the small trader?—No, I do not.

4033. (*Dr. Bulstrode.*) With regard to cream, you said that if preservatives were prohibited the potted cream industry would be destroyed?—Absolutely, I am told.

4034. Are you aware that the Aylesbury Dairy Company are able to carry on a trade in cream without preservatives?—For about three days only.

4035. They do supply their customers with cream without preservatives?—Yes. All these things are possible, but it is a question of time. The Aylesbury Dairy Company may have a few pots of cream, and sell them. It is all right if you can sell them at once, but if you are going to trade in potted cream you must have it so that it will keep a week or a fortnight; and that is impossible without the use of a preservative.

4036. Do they not trade in potted cream; is that not trade?—I believe if you get one three days old, or something of that sort, you will find it is not what you would consider fresh cream. I have endeavoured to ascertain the health of workers in borax and boric acid factories, and the health of the workers is phenomenal.

4037. (*Professor Thorpe.*) Better for it, in fact?—Better for it unquestionably.

4038. (*Chairman.*) Their health is phenomenal?—Yes.

4039. Could you explain that term?—I mean they are the better for it, as Dr. Thorpe has suggested.

4040. You mean that their health is good?—Their health is very good.

4041. (*Professor Thorpe.*) Phenomenal means in consequence of boracic acid or borax, surely?—Yes, I think I am almost right in using the term. I have heard from these workers in borax that a case of illness is very rarely to be met with in their factories, and I can mention the names of these—Borax, Limited (they have men who have worked there from fifteen to twenty years), the Patent Borax Company, Limited, Birmingham; Howard and Sons, Stratford; the Agricultural Chemical Company, Glasgow; Glacialine, Glasgow; and Joseph Townsend, Limited. There is one thing I should like to draw the attention of the Committee to; I do not know whether it is before them. We have a standard work on "Applied Chemistry," of which Dr. Thorpe is the eminent editor, and in which I find this expression:—"Boric acid, H_3BO_3, is largely used as a preservative of food. Like borax, it has gained favour, because of its harmless character, which particularly adapts it for food preservation. Fish have been preserved on a large scale by means of boric acid, and with very satisfactory results. The dry boric acid is placed in very thin alternate layers between the fish in barrels. It is also used in solution for the same purpose, both methods being still in use, in Sweden particularly. As an antiseptic, dressing for wounds, etc., boric acid has gained favour, on account of its non-poisonous nature, and the fact that 5 per cent. solutions can be used without causing irritation to the most delicate surfaces. The varying influence of boric acid upon different fermentations has been investigated by Herzen. He finds that the conversion of starch into glucose by the ordinary or pancreatic ferment is not influenced by boric acid, even when the menstruum is a saturated solution."

4042. Who was the author of that article?—The article I am reading from is the article on disinfectants, and it is written by Allen, a public analyst. It goes on to show the harmlessness of boric acid, and a little later on we have an account of what boric acid is used for, and actually it is recommended for the use of milk:—"Borax in the proportion of one pound to 100 gallons of milk has been used as a preventative of decomposition during the summer months, when milk is prone to change, and it has undoubtedly a powerful action, for it is quite possible to keep milk sweet for from three to four days in the height of summer under such conditions." That is in a standard work; and I say that to my mind it is hardly fair that a man should be prosecuted when such statements are made in a standard work that has only been out nine years.

4043. (*Dr. Bulstrode.*) That is a good long time for a standard work?—Not for a standard scientific work.

FIFTEENTH DAY.

Tuesday, 16*th January*, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart. M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. ALEXANDER G. R. FOULERTON, called; and Examined.

Mr. A. G. R. Foulerton.
16 Jan. 1900.

4044. (*Chairman.*) You are bacteriologist to the Middlesex Hospital, I believe?—Yes.

4045. And a Fellow of the Chemical Society?—Yes, and a Fellow of the Royal College of Surgeons.

4046. Also Lecturer on Public Health to the Middlesex Hospital Medical School?—Yes.

4047. We understand that you have arrived at certain conclusions in regard to the use of preservatives in food as to whether it is desirable that any restriction should be placed upon them?—Yes, I think that preservatives in milk are necessary to a certain extent, especially in the case of small retailers who have to supply the poor and cannot get rid of their surplus stock of milk as larger dairies can. I think that for the ordinary individual who takes a small quantity of milk the amount used of those preservatives, boric acid and formic aldehyde, is absolutely harmless. On the other hand, I think that for an invalid or a child the amounts might be, and probably in some cases would be, decidedly hurtful. I think that boric acid might be injurious because in the amount that it might be taken by an invalid or a child it is capable of producing toxic symptoms; but I do not think the formic aldehyde would produce toxic symptoms, though I think it might make the milk a little less digestible. On those grounds I think that the public ought not to be allowed to buy preserved milk without knowing that it is preserved, in order that invalids and children may be guarded

4048. Have you formed any opinion as to what is a safe amount of each?—The amounts which I think are safe for the average individual are 35 grains per gallon of boric acid, and about 1 in 50,000 of formic aldehyde, that is to say, supposing that not more than a pint of milk or thereabouts is taken a day.

4049. One part in 50,000 of formic aldehyde did you say?—Yes, and one part in 2,000 of boric acid; that is enough to keep milk sweet for about 24 hours.

4050. Have you any opinion as to the period after milking at which these preservatives should be added to the milk?—Immediately. I do not think they ought to be used to keep a stale milk; but they ought to be used to keep a good milk sweet.

4051. Do you know whether it is the case that it is not the usual custom to add them immediately after milking?—That I know nothing about.

4052. You do not know where these preservatives are added?—No.

4053. Of course, if they are added by the vendor a considerable interval must take place between milking and the time the milk comes into the vendors hands?—I take it that in a large number of cases the milk comes into the vendor's hands possibly within twelve hours of milking at any rate, and very often earlier.

4054. There might be considerable bacterial activity within that time, might there not?—There always is I think.

4055. It would be desirable to stop it?—Quite so.

4056. By the early application of the preservative?—Quite so.

4057. That is if applied at all?—Yes.

4058. You spoke of the difficulty of small vendors in poor neighbourhoods. Is that difficulty insuperable?—I take it it is from the nature of things, because a small vendor gets a certain supply of milk, and he must sell off what he has to a certain extent. I take it that it is almost impossible for poor people in London to get a good fresh milk.

4059. Under the present system?—Under the present system.

4060. But do you think that the present system is not capable of being modified so as to ensure a good supply to most districts?—Not without doing away with the small retailer. I think a large dairy company can always supply a good milk without a preservative, because they have got means of getting rid of their surplus milk. They get their milk up twice a day from the country, and they have a large clientèle; if any milk is left over it may be sterilised and put up in bottles, or it can be used for cream or for butter; a small retailer cannot do that.

4061. Are you aware of the circumstances which prevail in large towns in foreign countries?—No, except that I hear the use of preservatives is prohibited abroad in a good many places. I think the difficulty really only arises in very large towns where milk has to be brought in from a long distance.

4062. What I want to arrive at is whether you consider the interests of the small vendor as superior to those of the general public?—No, certainly not.

4063. Do you consider the interests of the general public in poor districts would suffer if the small vendor disappeared?—Not at all; they would be improved.

4064. The supply would still be kept up by other means?—If it could be; if you could do away with the small vendor and allow none but large dairy companies it would be an excellent thing for the public health; but I do not know whether it would be practicable.

4065. Do you think the notification of the presence of a preservative is desirable?—From the public health point of view I think it is essential, so that the public may know whether the milk they are buying is fit for invalids as well as for ordinary use.

4066. It has been represented to us that that would be nearly as fatal to the small vendor as prohibiting the use of preservatives altogether?—I do not think it would, because even poor people must get milk, and they will get it somehow. I do not think any trade interests ought to be allowed to stand in the way at all.

4067. Would you see any difficulty in requiring a declaration of the amount of preservative used?—I do not think that would be necessary if the amount allowable were fixed. If a milk were sold as preserved milk, or under some such name, I do not think it would be necessary to state the exact nature of the preservative or the amount, if those were fixed officially.

4068. There are other articles of food besides milk and dairy produce which contain preservatives, are there not?—Yes, I believe so.

4069. Have you any experience of those, or any views upon that part of the question?—The only views that I have are that they should all come under the same regulations as milk—that if preserved then the preservative should be declared; but I do not think that a preservative is so necessary in the case of other foods as it is with milk.

4070. I suppose that sterilisation would assist the preservation of milk, would it not?—Decidedly.

4071. Especially if it were bottled?—Yes, but then I believe that is expensive.

4072. Have you formed any estimate of the expense?—

Mr. A. G. R. Foulerton.

16 Jan. 1900.

No, I only know that sterilised milk in bottles is much more expensive than it is when bought in bulk.

4073. Where? In London?—In London. In Paris at the present moment, in some of the hospitals, it has been found necessary to supply sterilised milk for children, because it is found that the poor people cannot buy it, and therefore it is given them from the out-patient department of the hospital.

4074. Have you any knowledge of the system in Copenhagen?—No, I have not.

4075. The expense would be mainly a question of management and system, would it not?—I believe so.

4076. Then I understand that generally you are in favour of declaration rather than prohibition?—Yes.

4077. (*Professor Thorpe.*) I believe you have made a number of experiments in conjunction with Dr. Rideal?—Yes.

4078. And of course you are generally familiar with his work?—Yes.

4079. He has no doubt shown you the results of his experiments relating to the change of milk under the influence of various antiseptics and preservatives?—Only in connection with the boric acid and formic aldehyde; I believe he has done others, but I do not know anything about those.

4080. We will confine ourselves to the action of boric acid and formaldehyde. You have already told the committee that you share Dr. Rideal's view that one part of boric acid in 2,000, and one part of formaldehyde in 50,000, are sufficient?—Yes.

4081. Do you know that Dr. Rideal's experiments on milk containing those amounts of preservatives actually show that they have little or no practical effect in preventing the change in milk?—No, I was not aware of that.

4082. Are you familiar with the amount of formic aldehyde which is recommended by the company that vends formic aldehyde for the purpose of preserving food?—I do not know, but I gather that it is about 1 in 50,000.

4083. It is not more than 1 in 50,000?—No, I think not; but I have only a general impression on the subject.

4084. Of course, when I say formic aldehyde you understand that I mean formalin, which is a 40 per cent. solution of formic aldehyde?—Yes.

4085. You think the company recommend 1 in 50,000 of that?—I have always understood the amount recommended is 1 in 50,000 formic aldehyde.

4086. Is this limiting value which you and Dr. Rideal have arrived at based upon your own observation or upon the information given to you by the company?—I think it was based originally on a paper by Mr. Thompson, published in the "Analyst," who also carried out a number of this sort of experiments some two years ago. He found that one part in 8,000 of formaldehyde, which is a much larger amount of course, kept milk sweet for a week, and that one part in 2,000 boracic acid kept milk sweet for a week, and I have given no information of the sort to any company.

4087. (*Chairman.*) In summer weather?—At room temperature I think it was, that would be probably about 15 to 18 degrees centigrade.

4088. (*Professor Thorpe.*) Then these limits that you have given us, I understand, are not arrived at by your own independent observations?—Partly. I have taken milk this summer. I have not titrated it to get the exact acidity, but I have kept milk with 1 in 50,000 of formic aldehyde, and I have found that next morning it was still sweet.

4089. (*Chairman.*) How long had that milk been left at your house?—Probably for only a few hours. It was milk I got myself in the country, and I understand the cows are milked in the early morning. I got it at 8 o'clock, so that it was probably fresh milk.

4090. (*Professor Thorpe.*) It did not occur to you to make a blank experiment to see whether milk with formaldehyde behaved in the same way?—Certainly it did.

4091. You did?—Yes. I have been continually doing blank experiments.

4092. Did you make any estimation of the degree that that milk changed?—No, I did not estimate the acidity volumetrically.

4093. Then may I ask how you knew it changed?—By the smell and by the taste; by the smell principally, as there would be a distinct sour smell about it.

4094. A smell of what?—A smell of sour milk.

4095. What is that smell?—It is the result of probably several organic acids.

4096. Would you kindly tell the Committee what it is?—I do not know. I do not think anybody is in a position to say what is the exact composition of sour milk or the exact proportion of the different acids produced in the fermentation of lactose by bacillus coli communis and other bacteria. I do not know what the smell is exactly due to.

4097. Do you wish to tell the Committee that coli—coli communis, is it?—Yes.

4098. Is that the organism which is concerned in the lactic fermentation?—It is one of a large number of organisms which are found in milk, and which cause a fermentation of its constituents. I have noticed the bacillus coli communis, and I have certainly noticed the bacillus acidi lactici, and, of course, a number of putrefactive bacteria.

4099. I did not ask about what is found in the milk, I asked about what is concerned in the lactic change?—I do not think the lactic change is due to any one bacillus.

4100. Is it not the fact that you can introduce lactic change into the milk by the introduction of a specific organism?—You can produce lactic change in milk by the decomposition of lactose by introducing a number of different organisms, of which the bacillus coli is one and the bacillus acidi lactici another. There is quite a large number of other organisms which will ferment lactose; in fact nearly all those which curdle milk.

4101. Is it, or is it not, the fact that the smell we associate with sour milk is mainly due to the formation of lactic acid?—I believe so.

4102. Lactic acid is therefore the acid of which you determine the acidity?—No.

4103. What are the other acids?—I believe Dr. Rideal did not determine the amount of any one acid. It is the total acidity in terms of lactic acid that we determine.

4104. What is the acid which is mainly concerned in giving the acid reaction of milk?—Lactic acid, I believe.

4105. Out and beyond any other acid?—Yes, but there are several other acids undoubtedly present; butyric acid and others are present here.

4106. We are rather fencing about a trifle, are we not; it is primarily lactic acid, is it not?—Primarily, yes.

4107. Are you aware whether the company which is interested in the sale of formalin had always recommended a limit of 1 in 50,000?—I have not the least idea.

4108. Are you aware whether it is the practice of the more important milk distributing agencies in London to make an inspection of those farms from which they arrange for the supply of milk to them?—I believe so.

4109. They do?—Yes.

4110. They concern themselves with ascertaining that the sanitary arrangements of such farms are in good order?—Yes.

4111. And that they have a plentiful supply of water?—I understand so.

4112. Do you not think that all those are factors which determine the keeping quality of a milk?—Certainly.

4113. And, therefore, the use of preservatives is to counteract the effect of uncleanliness?—Certainly not.

4114. In the sanitary surroundings I mean?—No; at least I would not suggest the use of them on those grounds.

4115. Is it not the fact that it does tend to prevent the change which would go on in milk in consequence of the influence of insanitary surroundings?—I do not think that any milk will keep good for twenty-four hours in very hot weather. It is impossible to get milk in any condition other than containing a large number of bacteria, and even if the milk is cooled down at once I do not think in weather such as we had last summer it would be possible to keep that milk for twenty-four hours in a healthy condition.

4116. That was an abnormal condition of things last summer?—But it occurred.

4117. It occurred, but it might never occur again for ten years?—Yes.

4118. It is, therefore, to that extent an abnormal condition of things?—Yes.

4119. It would not be required in such weather as we have now got, would it?—No.

4120. If preservatives can, as you say, be prohibited without any inconvenience on the Continent in the supply of towns containing upwards of half-a-million of inhabitants, for example, what is the insuperable difficulty as regards English communities?—I am not prepared to say, but I think it is not a matter which concerns the vendor alone. The vendor in a poor district in London may sell in the afternoon, we will say, a perfectly good milk without a preservative; it is taken into a dirty, filthy little room, where half-a-dozen people are living, and it is an advantage to the public health that the milk should be kept in a good condition for the rest of the day, we will say, after it has got into that dirty room. I am not looking at it from the vendor's point of view, I am looking at it entirely from the public health point of view.

4121. But surely those are conditions under which milk should not be kept?—It should not be, but must be under existing conditions.

4122. Why?—Because I take it the poor people have to buy their milk and to keep it in their rooms.

4123. Then the use of preservatives would lead to the continuance of those conditions?—I should hardly like to say that, but they are conditions which exist at present.

4124. The object, I understand, of preservatives is to avoid the natural consequences of such conditions?—It is to avoid the consequences of the milk souring or decomposing.

4125. From the conditions under which it is kept?—From the conditions under which it is kept, and from the bacteria in it.

4126. Therefore obviously instead of preventing the natural effect of such conditions, surely we ought to remove the conditions?—Certainly.

4127. Then if steps could be taken to remove those insanitary conditions you would see no reason why preservatives should be continued to be used?—None at all if the steps were successful.

4128. (*Dr. Bulstrode.*) You said just now, if I understood you correctly, that you think the conditions which obtained last year *quâ* temperature were such that it would be impossible to carry on the milk trade without preservatives?—No, I said under certain conditions. If the retailer could get his two supplies of milk properly cooled and fresh every twenty-four hours then I think that it would be quite possible to keep the milk. I am not sure, but I take it that the small retailer probably in most cases only gets one supply a day; and not only that but after a customer takes over the milk it is kept in a very large number of cases in London under very insanitary conditions.

4129. About what proportion of the population would you say is supplied by the small retailer, roughly speaking?—I have not the least idea.

4130. A large proportion?—A very large proportion indeed, I imagine.

4131. If that is so, and preservatives are necessary for the small retailer, would you not be rather surprised to hear that the City of Birmingham is supplied with milk without the use of preservatives, either formalin or boric acid, with the exception of 9 per cent. of the supply—that 91 per cent. of the milk supplied to Birmingham is apparently, judging from the statement of Dr. Alfred Hill, the analyst, supplied without any preservatives?—I do not know anything about that.

4132. Supposing that to be the fact, would that not rather alter your view as to the necessity of preservatives, if a population of over 500,000 can be thus supplied?—I take it that that depends very much on local conditions. I suppose they can get their milk up sooner, but I cannot conceive that in a large town milk will keep well in a crowded tenement house, in hot weather, after twenty-four hours—I cannot conceive it.

4133. If that is the fact would that not rather be an element against that position?—Yes, certainly.

4134. Take the population of Vienna—a population of at least 1,500,000, I think. Apparently Vienna is supplied with milk without preservatives; now, if that can be done there, would you not say that is a strong argument against the pressing trade necessity of preservatives?—I really cannot express any opinion on the point. I know that practically one finds even in one's own house that milk, whether preserved by the dairyman or not, frequently will not keep in hot weather.

4135. (*Chairman.*) Whether preserved or not?—I take it milk as it comes from the dairyman will not keep in hot weather very frequently.

Mr. A. G. R. Foulerton.

16 Jan. 1900.

4136. (*Dr. Bulstrode.*) Nevertheless, if those are facts they tend to show that no very great inconvenience results from the absence of preservatives?—Then one would like to know the infant mortality of those cities.

4137. I think there would be no difficulty in supplying you with the mortality in Vienna and in Birmingham—certainly not in Birmingham. As a sanitarian, would you not prefer to see a condition of things which puts a premium on cleanliness rather than one which may tend to hide the effects of dirtiness?—Certainly, without any doubt at all.

4138. Now, with regard to the use of formic aldehyde, on page 28 of the copy of the statement you so very kindly sent me, you say: "I have found that fish will live and thrive in water containing 1 in 40,000 formic aldehyde. Those goldfish, tench, and minnows were kept in a small aquarium containing a formic aldehyde solution of this strength. At the end of a fortnight, owing to a mismeasurement by an assistant, the proportion of formic aldehyde was increased to 1 in 20,000, and the result of this was that all the fish were dead within five hours." Does that not rather tend to show that in dealing with formaldehyde we are dealing with a somewhat dangerous material?—Yes. That case was very striking indeed. Those experiments were merely carried out to test the effect of formic aldehyde on living proteid material; but it is a very different thing for a fish to be living continuously in 1 in 25,000 formic aldehyde, and for a human being to be drinking a pint or two of it.

4139. Would you not rather regard that as a danger in the use of formic aldehyde?—I do not think that formic aldehyde, taking into consideration the amount that would be taken in milk, is a toxic substance in those strengths. Of course, it is a very powerful poison indeed if not diluted.

4140. But still it only means really doubling the amount which you stipulate for milk, does it not?—Yes, just doubling it.

4141. So that if anyone made a mistake, and put double the amount that you recommend in, then he might be, or she might be, consuming milk, or, say, water which might be fatal in five hours to fish?—Yes. But then, on the other hand, I have done experiments on the frog's heart, using one in ten thousand formic aldehyde. That apparently had no action on the tissue. That experiment was of the same nature as the fish one.

4142. Can you tell the Committee whether as the result of your experiments you think it easy to quantitatively determine the amount of formic aldehyde?—I do not know anything about that. I should think it would not be very easy, but I do not know.

4143. We have had it in evidence that it is in fact impracticable at the present moment to quantitatively determine it?—I should think that is very probable.

4144. If that is so do not you see risk of these conditions as regards the fish experiment being reproduced in practice—assuming you cannot quantitatively determine small amounts?—I think that if it had to be done analysts would probably do it; but still the danger exists.

4145. We have had a lot of evidence to the effect that it cannot at present be done?—Quite so; I can understand that.

4146. Then with regard to the interference of even this small amount of formic aldehyde upon the digestibility of certain foodstuffs; do you think that the diffusion of a foodstuff thus treated with its digestibility even a little impaired might be a relatively serious thing for a large number of people who are suffering from some digestive disturbance?—There, again, I think you have to make two classes of people, first people who are taking milk as their principal food, for whom it would be decidedly injurious; and secondly, the ordinary adult, who takes a little milk in his tea, and possibly some milk pudding. In the latter case I think the loss of proteid material would be so small comparatively, having regard to the amount of milk taken, that I do not think if the use of the preservative is advisable in other ways that I would allow that to influence me in the matter.

4147. How would you propose in your scheme to guard invalids against the effects which it might be agreed would accrue?—You cannot guard invalids against it, but you can guard the person who buys it. People would soon get to know that preserved milk was not a fit food for invalids, just in the same way as I say in this paper that salt beef is not fit for invalids' diet; and then people simply would not buy preserved milk if it were to be used for invalids.

Mr. A. G. R. Foulerton.

16 Jan. 1900.

4148. Do you seriously think that the poor people of England will ever—at any rate, in our time—be educated up to the knowledge that certain preservatives may be harmful under conditions, and certain others may be the reverse—beneficial; do you think it is possible that the poor people will ever appreciate that?—I think that poor people might understand that preserved milk was not as good for an invalid or a child as fresh milk, if there were simply the two classes, fresh and preserved milk. I do not know, but I think that is possible.

4149. You will admit, I suppose, that there is a very large population altogether upon whom the exhibition of milk, whether preserved with boracic acid or formaldehyde, would be contra-indicated?—Certainly.

4150. And that those people might not come under the head of invalids, and might not really know that in a sense it was contra-indicated?—I suppose that might be so.

4151. Then with regard to the use of the term "preserved," do you think that the poor people when they speak of preserved milk do not rather mean preserved tinned milk?—Yes, they do at present.

4152. Is it not possible that it might be many years, and therefore many, I will not say lives, but healths, might be prejudiced while the public were learning to discriminate between tinned, preserved milk and formalised milk?—I think that both are equally injurious to children and invalids.

4153. For the sake of argument, supposing it were impracticable to limit the addition of preservatives to the maxima which you have laid down, then what would your position be as regards preservatives?—The position would be, I take it, practically as it is at the present time.

4154. Leave things as they are?—Either that, or else prohibit the use altogether.

4155. We have been told that as much as 80 grains of boracic acid have been found in a pint of milk; would you be a party to allowing that condition of things to exist?—No, certainly not; I do not at all take that view.

4156. Then to repeat my question. Suppose those suggestions of yours are impracticable, what would you then advise?—I think I should be inclined to advise prohibiting chemical preservatives altogether.

4157. Their total prohibition?—Yes, I think so.

4158. You know the Aylesbury Dairy Company carries on its trade without preservatives?—Yes, I believe so.

4159. And that they draw their supply from a considerable area in the country around London?—Yes.

4160. (*Dr. Tunnicliffe.*) The influence of formic aldehyde, and indeed of the other preservatives, so far as your experience of digestion went, I take it was small?—The influence of either preservative so far as it directly affects the action of the enzymes themselves is very small indeed. I take it that the formic aldehyde forms a combination with the albuminous matter, with the casein, so as to render that less digestible.

4161. Have you made any experiments on the digestibility of sterilised milk?—No.

4162. Is it a fact that sterilised milk is less digestible than ordinary milk?—It is said to be so.

4163. With regard to your experiments on the frog's heart, may I ask you what nutrient material you used for the frog's heart?—Normal saline solution.

4164. Therefore, under those experiments the actual muscular tissue of the heart, would be exposed to the action of formic aldehyde?—Yes.

4165. But there would be no chance of the formic aldehyde being fixed in any way?—The formic aldehyde was continually running over; it was applied continuously by immersion of the heart.

4166. Immersion of the heart?—Immersion of the whole frog.

4167. With regard to your suggestions concerning the authorisation of certain preservatives, what preservatives do you suggest should be authorised?—I think that would be a matter for a considerable inquiry. I am not prepared to say at present.

4168. I take it that you are alive to the fact that a difficulty in that method would be that the preservatives authorised would have to change from time to time?—Certainly.

4169. And I take it you would agree that the same argument would apply with regard to foods?—Yes.

4170. (*Chairman.*) Referring to the difficulty which you foresee in the case of small vendors, the difficulty is rather with the customer than with the vendor himself, is it not?—I take it, it is with both; that is to say in a great number of cases the small vendor's premises are not fitted to store milk; the milk is stored very often in dirty premises—not always—and goes from them into dirty premises.

4171. Would it not be greatly better that the premises should be cleaned?—Infinitely better.

4172. Then any step in that direction would be an advantage to the community?—Yes; those steps have been taken for a considerable number of years, but they have not arrived at a state of perfection yet.

4173. What I understand from you was that the chief difficulty arises when the poor purchaser takes the milk into his own house?—Partly that, and partly that the premises of the small retailer in a large number of cases are comparatively dirty, and not fit for storing milk in at all.

4174. Is it not the case that a great many consumers add preservatives to their own milk?—I do not know that at all, but I have been told that it is so.

4175. You do not know of anything to prevent them doing it?—Nothing.

4176. Then if the use of preservatives is desirable, and even necessary, in a certain class of houses they could be administered in that way?—Yes, but I think the poorer classes would hardly be able to measure out the amounts of preservatives it would be necessary to add.

4177. There are generally directions given on the packets, are there not?—I do not know; I have not seen the packets.

4178. You have never seen the packets?—No.

4179. You speak as if you are very familiar with the necessities of the trade?—It is a matter I have taken some interest in; but I have never seen the preservatives in the form that they are put up in for trade use; the boric acid and the formic aldehyde I have used have been taken from my own laboratory.

4180. Then in fact in speaking of the method of the small vendor you have not been speaking from the result of your own observation?—Yes; I have to a certain extent been speaking from what I have seen of poor neighbourhoods. I have bought milk for instance in the neighbourhood of the Tottenham Court Road, and I have inspected the premises of small vendors.

4181. If you had never seen the preservative they use how do you know they use it at all?—I only assume that they do from information which I have received from others.

4182. (*Professor Thorpe.*) Have you any idea how small an amount of lactic acid the taste would discriminate?—I do not know, but it is said that when the acidity of milk amounts to the equivalency of 0·5 per cent. of lactic acid—or 0·4 per cent, I think it is—then it can be distinctly tasted.

4183. 0·4 per cent.?—Yes, I believe so. I have not estimated it myself at all, but that is the prevalent idea.

4184. That is to say the amount of lactic acid or the equivalent of lactic acid must be equal to 0·4 per cent. before it could be picked up by the taste?—I believe so.

4185. Dr. Rideal handed in this Table *(showing a table to witness, and explaining same)*, in which he shows the results of taking the same sample of milk and incubating it at temperatures representing the ordinary temperature of the cold season of the year, the summer temperature, and an abnormally high temperature, such, for example, as you referred to as having occurred last year. He in all cases made blank experiments, that is to say, he took the same milk, and the same proportion of it, and to similar quantities he added boric acid and formaldehyde in the proportions that he and you recommend as proper amounts. Now he found the results shown in this Table. I may tell you that when he put in the Table the results were given to three places of decimals. The figures show the percentage amount of lactic acid formed after the various intervals of time. It was observed that at the temperature represented by the average temperature of the cold season of the year there was practically no change, or no difference in the change between the blank and the boric acid, and the formaldehyde; after fifteen hours, or even after twenty hours, or even after twenty-three hours, the amounts were the same. I may further tell you that he told the Committee that he attached no importance to the third decimal place, and that he considered the second decimal place as only approximately correct. His numbers absolutely show that at temperatures corresponding to the colder season of the year no change whatever took place in the milk. Therefore we may gather from these experiments that milk can be kept during twenty-four hours without the use of any preservative at all?—In cold weather?

4186. In cold weather. Now, let us turn our attention to the temperatures of summer. Here are the determinations of the amount of lactic acid after various intervals of time at 18 degrees centigrade, which is one of those temperatures you have mentioned. There was no further amount of lactic acid produced after twenty hours than there was after fifteen hours; indeed, if the experiment is worth anything at all it shows that in fact they were practically the same as you say. Assuming, as Dr. Rideal told us, that he attached only an approximate value to the second decimal place, no change occurred after twenty hours, and no change occurred after twenty-three hours at the summer temperature. Now, take the abnormal temperatures that you spoke of, and which we say can only occur relatively very infrequently. Precisely a similar condition of things was observed, that is to say, the amounts of lactic acid formed were not such as you yourself have just told the Committee that taste alone can discriminate; in other words, the preservatives had not the slightest effect whatever, even under the abnormal conditions of temperatures, and after the interval of twenty-four hours. Do not those figures show all that?—Those figures show that, certainly. But it does not follow, because the milk does not actually taste sour that it is necessarily as fresh as it should be in order to be a fit food.

4187. As a bacteriologist, and as a lecturer on public health, do you not think, in the general interests of the community, if the milk supply to a large community like London could be sterilised either by pasteurisation or by some other method, that that would have a very beneficial effect?—Certainly.

4188. Considering the prevalence that there may be of the tubercle bacillus in milk, and the difficulty of preventing its access, it would be a very great benefit to the community if sterilisation should be insisted on?—I doubt very much whether the temperature for pasteurisation would have much injurious effect upon the tubercle bacillus.

Mr. A. G. R. Foulerton.
16 Jan. 1900.

4189. What inhibiting effect, or injurious effect would it have?—I would like the temperature of 90 degrees centigrade for the tubercle bacillus, as there is at present some doubt as to the exact temperature at which this bacillus is killed.

4190. What is the actual temperature at which pasteurisation is usually conducted?—I think it varies; from 70 to 75 degrees centigrade, I think it ought to be; but I have not any practical experience of it on a commercial scale.

4191. You have no practical experience of it?—I have not seen it carried out for milk for commercial purposes.

4192. Pasteurisation is really effected at a very much higher temperature than what you say; it is really effected occasionally at a higher degree than 90 degrees centigrade?—Pasteurisation?

4193. Yes. What is the common temperature at which sterilisation is done apart from pasteurisation?—100 degrees centigrade; but in milk a temperature of 65 degrees centigrade will kill a large number of the bacteria, but not the tubercle bacillus.

4194. *Solvitur ambulando;* let us take one thing at a time. If, therefore, it is found possible to heat the milk to a temperature of 65 degrees centigrade that would be a very considerable benefit to the community?—Certainly.

4195. (*Dr. Bulstrode.*) With regard to the point which Professor Thorpe has just raised, do you know what would be the effect of the amounts of boric acid and formaldehyde on the typhoid bacillus, and the tubercle bacillus, and the cholera vibrio?—They would not destroy the bacteria, but they would check the rapidity of their growth, speaking in general terms.

4196. The amounts in no case would be destructive of life?—In no case would they kill the bacteria in milk; they might hinder their growth, but not kill them.

4197. That might be either an advantage or a disadvantage, might it not?—I am not prepared to say.

4198. (*Chairman.*) There would be a very strong prejudice against the universal use of sterilised milk, would there not?—I do not know about the prejudice, but as far as I know anything about it, it is a rather expensive process. Certainly if it could be done I think it would be the best thing. I quite think that, if it were practicable.

Mr. HARALD FABER, called; and Examined.

Mr. H. Faber.

4199. (*Chairman.*) You are a Fellow of the Chemical Society, I understand?—Yes, I am.

4200. And a Commissioner of the Danish Government?—Yes.

4201. You have held an appointment under the Danish Government for some years?—Yes, for eleven years I think it is.

4202. What is the exact nature of that appointment, and what are your duties?—To watch the interests generally of Danish agricultural produce coming to this country, to keep the Government informed of various things connected with that, to see that no misrepresentation takes place, to advise as to improved methods of manufacture and sale, or finding new outlets in this and other countries.

4203. In the discharge of these duties your attention no doubt has been drawn to the subject of preservatives in food?—Yes.

4204. Have you come to any conclusions on that matter; have you formed any opinion?—Yes, I think that preservatives ought not to be used in food, at least not unless declared.

4205. What is your objection to them?—I think there may be two objections in principle to the use of preservatives. In the first place they are chemicals, and the people using them not being generally chemists are unable to judge of the quality of the articles they use; they are also generally ignorant of the effect of them. It, therefore, seems less safe to leave it to them to decide whether to use them, and in what quantities, and so on. That is my objection in the first instance. Secondly the idea of adding preservatives to foods is to prevent them from decomposing, but in the course of digestion these same articles of food are intended to be decomposed, and I therefore think that as far as the preservatives prevent these foods from decomposing by their use they also are liable to prevent the proper digestion of them.

4206. In your country the Legislature has taken certain steps in regard to these substances, has it not?—Yes. The use of salicylic acid and boracic acid, and certain mineral salts in wines and spirits has been prohibited, and the use of saccharine in beer and wine is not allowed unless declared on the label.

4207. The other substances being prohibited altogether?—Salicylic acid, boracic acid, and the salts of aluminium, barium, strontium and magnesium and "other ingredients injurious to health" are prohibited altogether in wine and spirits.

4208. Has that expression "injurious to health" not been found a difficulty in administering the law?—I suppose it would be decided in each case as it crops up. There is an expression of opinion by the Royal Board of Health, dated October, 1895, that the use of boracic acid or borax in food to such an extent that one gramme daily is consumed, is liable to be injurious to health. (*See App. No.* 27.) The use of salicylic acid in food is prohibited by the Board of Health for Copenhagen altogether, since 1886.

4209. Did the prohibition of boracic acid, salicylic acid, and the other salts in wine arise from the fact that they were habitually and extensively used in wine?—I do not know whether that was so. Boracic acid and salicylic acid are prohibited because they are considered injurious to health; the others, I think, have been used in some way for treating the wine.

4210. We have heard a great deal about the convenience of preservatives in the dairy trade; your people are great producers, are they not?—Yes.

4211. Do they find any inconvenience in not using preservatives?—No, none at all. The use of any other pre-

Mr. H. Faber.

16 Jan. 1900.

servative than common salt is prohibited in butter and margarine.

4212. I should like specially to hear of the method of supply to the large towns such as Copenhagen. Copenhagen, I believe, contains about 400,000 inhabitants?—Yes.

4213. Is its population adequately supplied with milk?—Yes. Milk is used to a very great extent; I believe to a much larger extent per head than here; milk is consumed there very largely.

4214. Has any difficulty been experienced owing to the prohibition of preservatives?—No.

4215. Is the milk trade chiefly in the hands of large purveyors?—There are several large milk companies, but there are also a large number of small milk farmers, who bring their own milk in and sell it.

4216. Is most of the milk sterilised before it is sold?—There is one large company that sterilises every drop of milk sold by them; it is sterilised in bulk, and then bottled in sterilised bottles, and sold in that way.

4217. Is that Mr. Busck's Company?—No, that is the Pasteur Milk Supply Company, which is a newer one than Mr. Busck's. The company started, and managed by Mr. Busck, pasteurises some milk in bottles after it bottled, and sells it at a higher price; the other company pasteurises all the milk in bulk, and sells it at the usual price, even, I believe, a trifle below the ordinary milk price.

4218. Then they sell it also in bottles?—They sell it all in bottles, that is whole milk, skim milk, butter milk, and cream are all pasteurised. It is pasteurised to a temperature of at least 85 degrees centigrade, which is equal to 185 degrees Fahrenheit. I believe that is the only milk supply company that sells nothing but pasteurised mlik.

4219. Previous to the prohibition of these preservatives had they come into use in the butter trade?—To a very small extent. Several attempts were made to introduce them by travellers calling on the dairies, advertising, and so on, but they never succeeded. The dairies did not take to the practice, and they were strongly advised not to use preservatives.

4220. That is the dairies of the country, the factories?—The butter dairies and butter factories I meant; so that borax has never been used to any extent worth speaking of in Danish butter.

4221. Is much of your butter exported absolutely fresh—without any salt?—Some of it is exported without any salt at all, but not a very large quantity. Most of it is salted to some extent.

4222. Could you tell the Committee the percentage of the salt?—I should say about 1 per cent., or so. That term "fresh butter" is often used as equivalent to a butter without salt, but some of it also has a small amount of salt. There is some butter sent here without any salt at all, and some is sent with a small amount of salt, say, a quarter per cent. or so; but the large bulk is sent salted containing about 1 per cent. of salt as far as I know.

4223. That butter keeps a considerable time, I believe?—Yes, that keeps quite sufficiently long for the purpose of trade; that means two or three weeks as a minimum from the day of making.

4224. Do you find that the use of preservatives in Irish and French butter has interfered with the Danish trade at all?—No, not at all; I do not think that.

4225. It has been represented to us that the Irish butter has competed successfully by means of preservatives with the Danish butter?—I do not believe myself that the use of preservatives improves the keeping of the butter to any very great extent. We have found that by experiments. (*See App. No.* 26.)

4226. You mean that if butter is properly made?—It will keep sufficiently well without preservatives, and if it is not properly made—well, it is not a superior kind of butter.

4227. Now, is the Danish butter as a rule made of pasteurised milk?—Yes, nearly exclusively.

4228. Does that interfere with the flavour?—No. There is an Act in force now which has been enforced since the 1st July last, which is really an Act to prohibit the spread of tuberculosis amongst cattle, and therefore it is worded in this way—that no milk must be sent out from a dairy for the purpose of use for food for cattle without being pasteurised to at least 85 degrees centigrade. That applies to skim milk and butter milk, and therefore although this is done to prevent calves getting milk containing tuberculosis, it at the same time makes it necessary for the dairies to pasteurise the cream from which the butter is churned, because otherwise the butter milk would not be pasteurised. So that practically all the Danish butter is made from cream that has been heated to 85 degrees centigrade.

4229. Would it be possible or easy to distinguish between butter made from fresh milk and butter made from pasteurised milk?—Yes, you can do that by a colour test.

4230. What I mean is, is it easy for the consumer to distinguish by the palate?—No, but it can be done chemically. The flavour of the butter is the result of a fermentation produced in the cream after the pasteurisation.

4231. And that fermentation is not interfered with by pasteurisation?—No, it is helped by that. Before that Act pasteurising was used originally to overcome a certain disease in the milk of a certain dairy. They could not make good butter, and therefore they pasteurised the cream, and found out how to start the fermentation artificially. It was so successful that it spread amongst the dairies, even where they had no difficulties, and in the course of a few years 97 per cent. of all the dairies were using pasteurised cream.

4232. Now to pass to another subject. I do not know whether Denmark is a great producer of bacon?—Yes, it is, very. We send about one million hundredweight a year to England.

4233. Are there any statutory regulations about preservatives and the methods of curing bacon?—No there are not at present; but it is intended to prohibit the use of all preservatives in bacon and meat products generally.

4234. Upon what ground—that it may be injurious to the consumer?—Yes, that it may be injurious.

4235. Will that interfere much with the trade?—No. The preservative is not used very much in bacon. Borax, which is the only preservative in question in connection with bacon, as far as I know, is used to a very small extent in Denmark, and when it is used it is generally used for outside application, which does not leave the borax in the meat. I think you must in the application of borax to bacon, distinguish between the forcing of brine containing borax into the meat actually, and the application of borax in a dry powdered form to the outside of the meat.

4236. Its application in a dry form would not penetrate the meat would it?—No, I have found that by actual analysis; at least by sending samples cut for that purpose to Dr. Dyer, who did the analyses for me, showing that the outside of the meat would sometimes contain borax when a slice of the meat cut one-quarter of an inch further in would not show the presence of borax.

4237. You have spoken of injecting brine containing borax?—Yes, that is a way in which bacon is cured. A solution of salt which may contain borax and other ingredients, such as sugar, saltpetre, and so on, is forced into the meat by means of a pump; it is pumped at a high pressure of about 56 pounds to the square inch through a flexible tube which ends in a steel point, hollow and perforated laterally, and closed with a stop cock. The man that cures the bacon injects the steel point into the fleshy part of the bacon, opens the stopcock, and allows the brine to be forced into the meat. You see it swell out under the pressure. He does that in several places, especially in the thick parts.

4238. That is a brine of salt, I presume?—It is a solution of salt which may or may not contain also a preservative.

4239. That preservative being purposely added?—Yes. If that is added purposely, the bacon as consumed will contain borax, and that can very easily be found by analysis.

4240. Have you seen any recipe given for the formation of brine with preservative?—Yes. The way in which they in the factory dissolve these different ingredients in the brine is generally treated as a great secret. There was a recipe given in the "Grocer" some years back, in 1895, and according to that the brine was made up in the following way:—45lbs. of salt, 5lbs. of preservative, 4lbs. of sugar, and 3lbs. of saltpetre, to be made up by water to twenty gallons. I do not believe the use of sugar in that quantity is at all common for bacon made on a large scale in factories; but some saltpetre is used.

4241. There was another recipe given in the "Grocer," was there not, as to the formation of brine with preservatives?—That is the only one that I remember having seen. I have made some analyses of samples of smoked bacon to show the amount of common salt present in it. There were four kinds of bacon. The samples were rashers cut out of the bacon. A part was cut out of the fat, another part from the meat, near the fleshy surface, and another part from the meat in the inside. The four kinds of bacon so analysed were one kind of Danish bacon known in the trade as IDK, a kind of Wiltshire bacon known by the maker's name, Harris, a Dorsetshire bacon (Oake, Woods, and Co.), and an Irish bacon made by Richardson. The amount of salt in the fatty part for the Danish and Wiltshire samples was not ascertained, but in the Dorset and Irish bacons it was 0·23 on Oake, Woods, and Co.'s bacon, and 0·85 in Richardson's bacon. The amount of salt in the outside part of the meat was in the Danish bacon 3·75, in the Wiltshire bacon, 6·21; in the Dorsetshire bacon, 4·15; in the Irish bacon, 7·27. The percentage of salt in the inside part of the meat was:—In the Danish bacon, 2·18; in the Wiltshire bacon, 3·10; in the Dorsetshire bacon, 3·95; and in the Irish bacon, 4·03.

4242. All of these were mild bacons?—That is, bacon as it is sold in London at present.

4243. Do those percentages represent pure salt?—Yes. I draw the conclusion that if the recipe of brine as given in the "Grocer" was used, and if borax is absorbed by the meat in the same proportion out of the solution as salt is, the outside meat of this bacon would contain from 0·4 to 0·8 per cent. of borax.

4244. (*Professor Thorpe.*) Can you tell us what is the relative proportion of persons engaged in the manufacture of dairy products in Denmark to the proportion of people engaged in the manufacture of dairy products in England?—No, I could not tell you that offhand, but I might be able to find out.

4245. In Denmark I presume by far the greater portion of the community is engaged in agricultural pursuits?—About half of the population.

4246. About half of the community there is engaged in agricultural pursuits, do you say?—So I believe.

4247. (*Chairman.*) Would that include the urban communities—the population of Copenhagen for instance?—That is including the whole population of the country; about a half is agricultural population.*

4248. (*Professor Thorpe.*) I think you answered this question before, but I should like to get it again clearly. Does the pasteurisation of milk in any way affect its flavour?—It depends upon what temperature you heat it to, and how you manage it afterwards.

4249. I am speaking of the milk now?—If you heat it to over 85 degrees centigrade, it will sometimes leave a taste, but it is very slight, and it can be done without any taste at all, so that people are not able to distinguish between that and milk not heated.

4250. Is there any certainty when milk has not acquired this flavour that it actually has been raised to the temperature required?—Yes, I believe it is greatly a question of quickly cooling down. If you cool it down immediately after it has attained the highest temperature required it will not keep the burnt or scalded taste.

4251. Do we gather from you now that it is clearly recognised that by skilful and proper treatment pasteurisation has no ill effect upon the milk from the point of view of giving it an objectionable flavour?—Yes, it is a question of temperature. It can be done to 85 degrees centigrade without it getting such a flavour that it can be at all perceived by anybody. I have been myself present at an experiment where we heated milk to over 90 degrees centigrade, and we were unable by comparing the heated milk with unheated milk ourselves to distinguish which was which.

4252. Then, may we infer that it was a want of skill on the part of persons using the process that occasioned the disagreeable flavour in the milk?—You are referring to special experiments? I know nothing of them.

Mr. H. Faber.

16 Jan. 1900.

4253. We are sometimes informed that the pasteurisation of milk is not practicable on the ground that it gives an objectionable flavour to the milk. Does that correspond with your experience?—No, not at all.

4254. Has there been any difficulty in Denmark in persuading the people to adopt pasteurised milk for general consumption?—No.

4255. Is the whole of the milk consumed in Denmark pasteurised?—It is a very common thing for people to boil their milk supply every day if they do not buy it pasteurised. Raw milk is looked upon in Denmark by a very large portion of the population as something to be avoided.

4256. Do the milk vendors as a rule supply pasteurised milk?—No.

4257. They do not?—No.

4258. Is any large proportion of pasteurised milk supplied?—There is a very large supply company in Copenhagen which sells nothing but pasteurised milk; there is another very large supply company which sells a considerable amount of pasteurised milk, and there are several others which sell pasteurised milk. There is one town outside of Copenhagen where it is enacted by the Board of Health for the community that nobody shall sell milk except it is either pasteurised at a certain given temperature or derived from cows that have stood the tuberculin test.

4259. Is there an authority that controls the pasteurisation of the milk?—May I mention, before I answer that question, that there is no law in force to make it necessary to pasteurise milk for human consumption. There is a law in force to necessitate pasteurising milk for the consumption of cattle, and there are authorities, and active authorities, who see that all milk delivered out from dairies for consumption by cattle is thoroughly pasteurised, and when it is not so fines are inflicted. The officers are travelling about taking samples of the milk from the dairy factories in order to see that all the skim milk and butter milk has been heated to 85 degrees centigrade at least; the samples are then tested by the paraphenylendiamine test, which I am sure you know, and in that way it is controlled.

4260. Have the several municipalities any power to control the pasteurisation or the sterilisation of the milk supplied?—They have that power if they care to exercise it, and one town out of Copenhagen has exercised it.

4261. Does the law give them that power?—There is nothing to prevent a community requiring that all milk sold within their border should be pasteurised, and there is one community that has decided that it must either be pasteurised or drawn from cows that have stood the tuberculin test.

4262. How has the municipality got that power; under what Act does it acquire that power?—Under an Act which dates from 1861, I believe, but I would not be sure.* There is an Act for the election of sanitary boards within the different districts, and those sanitary boards or boards of health have that power.

4263. You told the Committee that borax has never been used in Danish butter, beyond mere experiments?—Yes.

4264. When you say borax I suppose you mean boracic acid?—I do not think I do. I believe what is used generally is borax or a preservative called preservitas; it has a number of names, such as glacialine, frigaline, icediline, and I do not know what. Nearly all of them are a combination of boracic acid and borax; they have been half melted together—fluxed—and then ground.

4265. It is that that you mean when you speak of borax?—Yes.

4266. Could you tell the Committee what induced the Legislature to prohibit the use of preservatives in butter?—Before they prohibited it there was that expression of opinion by the Royal Board of Health that the use of borax to a certain extent would be injurious to health in their opinion.

4267. Was it entirely, then, on sanitary grounds that the Legislature was induced to do this?—I do not know. I have not got the particulars, but that was one of the reasons put forward. Another reason put forward at the time was that it had better be prohibited now when it was not in use, because if the use of it spread it would be more difficult then to dissuade people from using it.

4268. But if it had not been proved that it was an

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* According to official statistics for 1890—

Total population - - -	2,172,380
Rural population - - -	1,450,136
Living by agriculture - -	882,336

(employers, employees, and dependents).

* Act of 28 March 1868 (also 12 January 1858).

Mr. H, Faber.

16 Jan. 1900.

injury to the trade of Denmark to use it why should they have prohibited it?—Because earlier or later it was believed that the use of boracic acid in foods would have to be prohibited, because if you have it in one thing and in another thing—in bacon, in butter, in cheese, in meat, in game, and so on, you may eventually consume daily such a quantity that it would certainly be found to be injurious. Then the Legislature of Denmark preferred to prohibit it in time before it got generally used in the country.

4269. Do you know of your own knowledge that that was an argument that was laid before the Rigsdag?—Yes.

4270. It was?—Certainly.

4271. It has been stated in evidence that one reason why the Legislature adopted this line as regards the use of preservatives in butter was as a species of protection. Is there any truth in that?—Protection may mean different things. I do not quite understand what is referred to here.

4272. (*Chairman.*) The protection of the industry?—Of course, it is a protection of the industry as well. It was believed that earlier or later the use of boracic acid would be prohibited because when it became spread to every eatable thing something would have to be done to put it down. Denmark therefore preferred to prohibit its use in butter before it got adopted in the country, so as to be ready when the time should come that it would be prohibited also here for instance.

4273. That is a far-sighted kind of protection that you imagine was alone in view—that kind of protection and no other protection; it did not give your trade any selfish advantage?—At the time?

4274. Yes?—Rather on the contrary. If there is any benefit to be derived from the use of boracic acid we clearly gave that away, and with some protests from several makers, I may say.

4275. You had protests?—Yes.

4276. (*Professor Thorpe.*) It has been stated in evidence that of late Danish butter does not keep so well as it formerly did. Has that come to your knowledge?—Yes, I have heard that stated, but I believe it to be entirely untrue. I have made inquiries as to that special point from traders in a very large way in England who have stated quite the opposite. Something has been advanced as a kind of argument to prove that. I do not know whether I may speak about that. It has been argued that it used to be the custom, especially in Scotland, to buy our Danish butter earlier in the year—in the late summer and so on, and store it for winter use, and that that custom has been discontinued. That has been taken as a proof that the Danish butter does not now keep so well. Of course, that is no proof at all. In the first place, people now prefer less strongly salted butter, more fresh butter. Of course, if you put a very large amount of salt in butter it will keep better than when you do not; secondly, the difference between the price of summer and of winter butter is not now so large as it used to be, and the supply of fresh butter from the colonies in the winter makes it much less necessary now to store butter made in summer. Besides that, butter is still kept in cold store, so that there does not remain much of an argument.

4277. It has been stated to us that practically all Danish butter is consumed very soon after it is made; is that correct?—Of course, it all depends upon what is meant by very soon. It will take as a minimum generally from two to three weeks from the time of making Danish butter to the time at which it is consumed. I believe that is an extent of time far beyond what is meant when you say "generally consumed soon after it is made."

4278. Would you kindly tell the Committee precisely the process by which the butter gets from Denmark into England?—Yes, with pleasure. It is made in the Danish dairies every day, that is churning is done every day, and butter is produced every day, but it is not sent away from the dairies generally oftener than once a week; and from that it follows that some of the butter when sent away from the dairies is a week old. It is generally sent in the beginning of the week to the exporter at one of the ports to be shipped in the middle or end of the week to England, where it comes into the market in the beginning of the following week, so that another week will elapse from the time it is sent away from the dairy.

4279. In other words, the butter may be a fortnight old before it gets to England?—It may be when it lands, and then the retailer generally buys his stock of Danish butter only once a week, and therefore the stock which he buys must last him a week; and some of the butter therefore will be three weeks old.

4280. (*Chairman.*) You are talking of the butter with one per cent. of salt in it?—Yes. I am talking of that salted butter. The fresh butter is treated in a different way; it comes here much quicker, and it is consumed much sooner after it is churned. But that is as yet only a comparatively very small percentage, say one or two per cent. of the whole amount of butter sent.

4281. (*Professor Thorpe.*) Then may we gather from the experience of the Danes that one per cent. of salt is sufficient to keep butter good and sweet for at least three weeks?—Yes.

4282. Is there any connection between the keeping character of butter and the amount of water which it contains?—Yes, we find that the more water there is, the less is the keeping quality of the butter.

4283. Does Danish butter contain relatively a large or a small amount of water?—It contains about 14 per cent. of water when it is shipped.

4284. Why do you specially say when it is shipped?—Because if you were to go into a shop, and buy a small sample of Danish butter and analyse it, you are likely to find less than that, because the water evaporates and the brine drains away from salt butter.

4285. How does the amount of water in Danish butter compare, say, with the average amount of water which is contained in Irish butter?—From the records I have seen of the amount of water in Irish butter that is higher than in Danish butter.

4286. What is the average amount from what you have seen in Irish butter?—I do not know that I have lately seen any statement about that, but there was a statement made some years ago which I included in a small pamphlet I wrote on the question of water in Danish butter.

4287. You have no actual knowledge of the present day manufacture of Irish butter?—I do not know that Irish butter is analysed for the amount of water sufficiently often to enable us to form any clear opinion about it. It wants a good many analyses made, because the samples vary very much. We have a good many thousands of samples of Danish butter analysed from which you can form a conclusion; but a matter of twenty or thirty or forty analyses of the water in Irish butter would give really no valuable information.

4288. Is it not the fact that in Ireland they have of late years conformed to your methods of manufacture in Denmark?—More than before?

4289. Yes; have they not more nearly conformed to your methods of manufacture?—During the last ten years or so, yes; they are progressing.

4290. Is there any reason known to you why the Irish butter to-day should not be as dry as your Danish butter?—Not the slightest.

4291. Not the slightest?—No. I do not believe the difference is very large if you take well-made Irish butter from the factories or what you call the creameries; I do not believe there is any great difference at all.

4292. There is nothing in the nature, so far as you know, of Irish butter which would cause it to hold a larger quantity of water than Danish butter holds?—No. I do not conceive that there could be anything.

4293. It entirely depends upon the mode of manufacture?—Yes; upon the mode of working the butter after it is churned especially.

4294. We have been informed in evidence that there are certain farms from which it is impossible to make a relatively dry butter?—Yes; I have seen that statement.

4295. Do you agree with that statement?—No, I cannot at all agree with that. I do not understand at all what relation there could be between the two.

4296. I suppose it is true that two farms side by side, we will say, may produce butter of a very different character?—No, not at all. I can give you, if not going too far, a small instance to disprove that altogether. At the time when the pasteurisation of cream in dairies was introduced into Denmark there was, as I have mentioned before, a disease in the milk on a certain farm in Jutland, a large farm which had suffered a great loss from the very faulty butter they produced; they had sent on to them from the Agricultural College in Copenhagen an expert dairyman and an expert bacteriologist, who found a certain bacterium infesting the dairy, the

Mr. H. Faber.

16 Jan. 1900.

milk, the water supply, and everywhere, which was the cause of the faulty butter.

4297. (*Chairman.*) Was that Professor Bang?—It was an assistant of Professor Bang—Doctor Jensen. They then introduced the pasteurisation of the cream before churning, and naturally after that they had to add some fermentation starter. It so happened that one of the people who was in Copenhagen on going back took with him a bottle of buttermilk from a dairy near Copenhagen which was well known for good butter; he brought a sample of this buttermilk to the dairy in Jutland, and added that to the pasteurised cream. Every week three sample casks of butter were sent from the dairy to Copenhagen to be judged by expert butter exporters. When this butter came before them that was produced from cream that had been soured by the buttermilk from this dairy near Copenhagen, and when the exporters came down to judge this particular butter, one of them smiled and said they were trying to play a trick on him, because that butter was not obtained from Jutland, that he could point out which dairy it came from, because he was in the habit of exporting that butter, and he gave the name of the dairy where the buttermilk had been derived from. This, I believe, proves that the flavour of the butter is dependent on the bacterial life you start in the pasteurised cream, and has nothing to do with the soil or the locality.

4298. Or the vegetation?—Or the vegetation either.

4299. Or, speaking generally, the food?—No, not to any very large extent. About food I could give you another instance. It was very frequently the case that exporters complained to the dairies that they used turnips, and that the butter tested turnipy, and in very many cases the producers of the butter knew that their cows had never been near to a turnip, yet at the same time the butter really did taste turnipy. That is produced by a certain bacterium which we now know.

4300. And which can be excluded?—Yes, by pasteurisation.

4301. (*Professor Thorpe.*) Have you any idea of the amount of water in Normandy butter?—As far as I have seen analyses of Normandy butter, it is rather below Danish butter. I take that to be partly due to the fact that they are all blended or milled butters. Normandy butter is produced in this way—the large firms buy up in the local markets butter made by small producers; they buy it up in lumps, and they bring these together and grade them, and work together those of the same quality. By that extra working I think an extra amount of water is taken out of the butter.

4302. Normandy butter has a character, a bouquet or aroma or whatever you like to call it, of its own, has it not?—Yes; but I suppose that varies very much—at least, it does with the different grades, the different qualities of Normandy butter.

4303. But there is some feature in Normandy butter which people prize; there is something apart from the mere glycerides of butter which people prize in Normandy butter, is there not?—Yes, in the finest. I believe the finest butter in the world is made in Normandy, in the Isigny district. It does not come to England though, it goes to Paris.

4304. What is it in the Normandy butter which gives it its characteristic flavour?—I think it is a very debatable point what gives butter its flavour; it is the bye-products from fermentation in the cream.

4305. It is not the food?—I believe not. Of course you can give food of such an objectionable character that it will impart a flavour to the butter; but generally speaking, the flavour of butter is produced by the fermentation, just as in wine, beer, and everything else that is fermented.

4306. (*Chairman.*) But it is not roughly the breed of cattle, as a rule?—I do not think the breed of cattle has the slightest to do with it.

4307. Nothing?—Not with the flavour.

4308. (*Professor Thorpe.*) Then you could in Denmark make Normandy butter by importing the bacterium or bacillus or whatever it is that does this?—I do not know that we could.

4309. Has pasteurisation had any deleterious effect upon your butter?—No, we believe it has had nothing but a beneficial effect, which we think is proved in this way: Long before it was enacted that cream should be pasteurised 97 per cent. of the dairies of their own accord pasteurised their cream, in order to produce better butter, it having been found distinctly at the butter shows that the prizes always went to the butter that was made from pasteurised cream.

4310. We have had it in evidence that the effect of pasteurisation has been altogether to spoil the flavour of Danish butter; is there any truth in that?—We had just the same complaints at the time when mechanical separators were introduced. There was a most strong expression on the part of all the merchants that in a separator you could by no possible means make saleable butter, and that they could detect it at once, but every time they were put to the test they failed to do so. It is simply a prejudice. There always is prejudice when a new thing comes out.

4311. That allegation as to the detrimental character of pasteurisation is an allegation of the same character you think; it is simply prejudice?—I look upon it in this way: at the butter shows butter merchants are the judges. They know nothing at all about how that butter is produced which they judge, and they have for years and years picked out the pasteurised butter as the best, and given it the prize. I do not think they can then turn round and say pasteurisation has a deleterious effect.

4312. Can you tell us anything about the regulations in force in Scandinavia as to the prohibition of preservatives?—Do you mean in Norway and Sweden?

4313. Yes?—No, I am not prepared for that at all.

4314. Does Norwegian butter imported into this country contain preservatives?—I do not know, that is to say I know from your reports that it does not.

4315. Other than that you do not know?—No, I do not; and the same applies to Swedish.

4316. (*Dr. Bulstrode.*) I should like to read an extract from "Whitaker's Almanack" as to the supply of Danish butter during 1898: "In the year 1898 the quantity of butter imported from foreign countries was 2,813,736 cwt., with a value of £14,140,738, rather more than half of which was imported from Denmark." You have no reason to doubt that that is practically true?—No, I do not doubt that; it corresponds with the published statement of the Board of Trade.

4317. Then more than half the foreign butter imported into this country is without what is usually known as preservatives other than 1 per cent. of salt?—Yes.

4318. That more than half will keep, can we say at least three weeks?—Yes.

4319. At least three weeks?—Certainly; of course the keeping depends upon the temperature at which it is kept.

4320. In the summer how long can we say?—Three weeks in summer.

4321. At least three weeks in summer?—Yes, and much longer in the cold weather.

4322. Would you mention a figure for the cold weather approximately—take now the present moment?—It is very difficult to pin it down to any time.

4323. Would you say five weeks?—Five or six or seven weeks. I do not mean to say that butter either in summer or in winter is just as good three weeks after it is made as when it was made; what I mean to say is, that in summer three weeks after it is made it is sold here as the best salt butter, and that is, of course, what we go by. I do not mean to say that butter will keep absolutely one week; it will always deteriorate from the time it is made and all along, and the warmer the weather is the quicker it will deteriorate. So how long it will keep is a very vague expression; it must be taken in a certain practical sense that within three weeks in summer the butter will keep and still be considered as fine salt butter, and in winter you can say five or six or seven weeks.

4324. Might we say that in summer the butter will fetch an equal price at the end of three weeks to that which it does at the beginning?—No; I do not think you can say that.

4325. Then for how long do you think it would fetch the same price?—Could not we speak in the commercial sense, and say it has kept three weeks, or it will keep three or four weeks in summer and five or seven weeks in winter, in a commercial sense.

4326. (*Professor Thorpe.*) Meaning that it is readily

Mr. H. Faber.

Jan. 1900.

saleable?—That it is readily saleable as the best salted butter.

4327. (*Dr. Bulstrode.*) Readily saleable at a reduced price?—No; at the top price in the butter market.

4328. But the value of the butter from its commercial aspect does go off from the time it lands, that is at the end of three weeks?—But butter, just as it is made, is not in the market here to be compared with it.

4329. I mean from the time it reaches these shores it diminishes in marketable value?—I do not quite follow you.

4330. At the end of the fortnight the butter from Denmark reaches our shores; it is then worth x; at the end of three weeks it is not worth that?—Between two and three weeks I do not think it would make much difference in the value.

4331. You think it would be of the same value in the market?—Yes, quite so.

4332. (*Professor Thorpe.*) I suppose really its value is determined by the effect of the conditions under which it has to be sold, is it not?—The value is determined by so many different factors that it is very difficult to estimate the value of one of them alone. It may depend upon the market, on supply and demand, and on the prospect for next week, and many other things.

4333. (*Dr. Bulstrode.*) As I understand you, you think that the breed of the cow has no influence upon the flavour of the butter?—None whatever, in my opinion.

4334. As regards the pasteurised milk, or the so-called pasteurised milk, which is sold in Copenhagen, which is pasteurised, or so-called pasteurised, at 85 degrees centigrade?—I think we might call that pasteurised.

4335. Has any question been raised by the medical profession in Copenhagen as to the prejudicial effect upon milk of that process by its altering its powers of digestibility?—It is recommended by medical men, and it is pasteurised under medical supervision.

4336. It is pasteurised with the view of partially sterilising it; but has any question of digestibility been raised?—No.

4337. (*Chairman.*) Is it not the fact that in Denmark and on the Continent generally it is very exceptional for raw milk to be drunk?—I think that is putting it rather strong. It is very frequently the case that milk is boiled before being drunk.

4338. That is the way you put it?—I do not know how far I could go. I know very many people that would not think of drinking raw milk.

4339. (*Dr. Bulstrode.*) With regard to the experiments you refer to as to the keeping of butter, could you furnish to the Committee the results of those experiments?—Yes. I believe I can: I believe they are published, and if so, of course, I will furnish them with pleasure.

4340. You could not give the Committee any idea as to what proportion of the population of Copenhagen is supplied with pasteurised milk?—No.

4341. Not roughly, quite broadly?—I really do not think I can.

4342. Would you say half?—No, I do not think so.

4343. A quarter?—More like a quarter; but my idea is not beyond that, and I question whether so much as that.

4344. Do you know anything as to the infantile mortality of Copenhagen?—Not now; I have had some figures, but I have not them in my hand.

4345. From how far is the milk supply of Copenhagen drawn, what distance out in the country, in miles?—As far as known to me about 120 miles.

4346. As much as 120?—Yes. I do not know whether it may be longer, but known to me, it is so much as that.

4347. How is the milk treated before it is sent by train?—It is cooled by ice to a low temperature, which is stipulated in the contract with the farmer. There is one large company in Copenhagen that receives the milk from a larger distance than others, and it is partly frozen by a patented method. As far as I know they freeze the layer of milk close to the can.

4348. How long has it been the practice to insist upon this partial refrigeration of milk?—That is only lately, but the cooling of the milk by means of ice has been in force at least as long as Mr. Busck's Company has been working; and that must be about 20 years I should think.

4349. What has been the cost of providing the necessary apparatus and material for cooling the milk?—I could not answer that, but in a large firm, compared with the value of the milk sent in, it would be quite an insignificant amount.

4350. Would it be difficult in small farms to bring that about?—To cool the milk do you mean?

4351. Yes?—To cool it with ice would be difficult. You see our small farms are not at all prepared to treat the milk; it is cooled in water, but it is sent up otherwise as soon as milked to the factory twice a day, to be treated there.

4352. It is cooled with water at the farms, and sent off and further treated at the factories?—Yes; and if there was a question of sending milk to Copenhagen from small farms any distance off, it would probably go through a dairy and be refrigerated at a dairy; that is the way in which I think it would be done.

4353. Would there be any difficulty in the members of the Committee, if it were thought desirable to visit Copenhagen, seeing the methods of treating milk and treating butter?—Not the slightest; they are very glad indeed to show how it is done. I myself believe that the methods of the Pasteur Milk Supply Company, which pasteurises all the milk, ought to be known more than they are, and imitated at other places. I believe it is an excellent thing.

4354. (*Chairman.*) Could you supply us with a copy of the report of the Board of Health upon which action was taken in regard to the prohibition of preservatives. I think you referred to a report of the Board of Health?—Yes; there is a statement of opinion by the Royal Board of Health in 1895 upon the danger to the public health of using borax in such quantities that as much as one gramme a day may be consumed. I do not believe that statement was handed in as a public paper, and I do not believe that it was actually made in connection with the prohibition of the use of borax for butter and margarine. (*See App. No. 27.*)

4355. No, but prohibition did follow upon it?—Two years afterwards it was prohibited.

4356. (*Professor Thorpe.*) To whom was the report made from the Royal Board of Health—to the Minister?—I do not know at this moment whom it was made to. I take it it was made to the Ministry of Justice, because these matters come under them.

4357. (*Dr. Tunnicliffe.*) Could you refer the Committee to any literature upon the subject of the bouquet of cream as produced by fermentative agents?—In the Danish language.

4358. If you would give the Committee even those references they would be of use?—Certainly.

4359. Experiments have been made upon the subject from a bacteriological standpoint, I take it?—Yes, many.

Mr. A. Gilbey.

Mr. Alfred Gilbey, called; and Examined.

4360. (*Chairman.*) You are a partner in the firm of Messrs. W. and A. Gilbey, wine merchants, Oxford Street, London?—Yes.

4361. We have asked you to come and give us information as to the use of preservatives in wine, of which we have already heard from other witnesses. Can you tell us, first, if their use is general, and secondly, if they are more used in one class of wine than in another?—The only preservative which it is necessary to use in wine imported into this country is brandy, which is distilled from wine, and this is only used in what are known as strong wines, viz., port, sherry, and Marsala. The grape yields more juice relatively than any other fruit that is produced. In the wine-producing countries the juice of the grape is so plentiful and so cheap that there is no reason for adulteration, and the colour of the wine is so pleasing in its natural state that no colouring matter is necessary, and it is preserved by the spirit produced by natural fermentation. Take, for instance, the production of claret, of which I have an intimate knowledge, for my firm have a large vineyard in the Medoc. The grapes are picked when they are fully ripe, and brought in to the cuvier, wehe the stalks are separated from the bunches, and the berries and juice go into a vat, where in a very short time the fermentation commences. The process of fermentation forces the skins and pips to the top of the vat, and also all impurities. The wine is drawn off in about ten days, and placed in hogsheads, where the fermentation goes on for about another nine months, after which it is placed in cellars, and kept there until three years old, when it is bottled and sent to this country, and sold at prices varying from 1s. per bottle upwards, and with slight variations all light wines are made in this way. In Continental countries, where wine is the daily beverage of the working classes, a cheap wine is made from raisins, but this wine is of such low alcoholic strength it can never be shipped, as it would not stand the journey.

4362. The evidence that we have received rather points to the use of preservatives, such as salicylic acid in another class of wine—a stronger, fruitier wine, such as some of the ports?—We heard some years ago on the east coast of Spain, where a very cheap red wine is used, that salicylic acid had been used; but in every contract we make with the producer (we do not make the wine absolutely ourselves), we stipulate that no salicylic acid should be used. We have that in all contracts in any place where we have a suspicion that it is being used.

4363. Then its use is known in wine-growing countries?—It is known, certainly; I have often heard it.

4364. Is it used more in an inferior quality of wine, or is it used in all qualities alike?—It would be used really in an inferior quality of wine, I should think, but it is absolutely prohibited in many wine-producing countries.

4365. What is the object of its introduction?—Of course to act as a preservative, and so as to use less spirit, I take it.

4366. Is it to arrest fermentation?—Yes, I think it is; but as I tell you, we have had no experience of it. It is easily detected in any wine. Any chemist can detect it quite easily, and no wine that we sell, or that I know is sold in this country, has any in. There is no reason for it being used in our opinion. I was making the statement with regard to wine generally, and I was saying that the cheap wine is made from raisins. We read a great deal very often in the Press about the adulteration of wine, and wine being made from raisins, and so on; that wine is never imported into this country, as it would not keep, and though people can drink it over there, it is sour stuff, and would be quite unpalatable here.

4367. Do you ever use tests for the presence of salicylic acid in wines?—We send our wine from time to time to analysts to be examined. We know it is not used really in the wine that is imported into this country, and we have never had a case of any wine where it was used.

4368. We have been informed that the strong, rich wines are treated with salicylic acid or formaldehyde to arrest fermentation, and are then used to mix with thinner wines; do you think that is practised to a large extent?—It may be. All we know is that there is a prejudice against it, and we do not let a particle of it appear in any wines that we sell.

4369. (*Professor Thorpe.*) Could Mr. Gilbey tell us any other wine than that which he says is produced on the east coast of Spain—of which, by the way, we did not hear the name?—Tarragona Spanish port.

4370. Are there any other wines than Tarragona which are likely from their nature to contain salicylic acid?—No, I do not think there are. I have never heard of it being used. As I tell you in France, I believe the use of it is absolutely prohibited.

4371. Take a fruity wine, containing a considerable quantity of sugar, which it is desired shall retain a certain amount of the sugar; is that not liable to contain salicylic acid?—No, I do not think there is any necessity why a really good, sound, well-made wine should contain salicylic acid.

4372. Perhaps there is no necessity, but as a matter of fact, is it done?—I do not think it is. We know samples are constantly taken by analysts in this country, and very rarely indeed have we ever heard of salicylic acid being detected.

4373. Sherry, for example, is not likely to contain any?—No, I do not think so.

4374. Take the German wines imported into this country, which are of low alcoholic strength; are they likely to contain salicylic acid?—No, they are very dry, there is no sweetness, and there is no sugar in them. They are natural wines, and they are not likely to contain salicylic acid.

Mr. A. Gilbey.

16 Jan. 190

4375. There are certain wines which do not, I suppose, frequently bulk in the imports, or even known of by name in England—wines produced in Portugal, for example. There is a wine that I know of, called Colares. I do not know whether that finds its way into this country?—I do not recognise the name of it, and I do not know where it is made.

4376. It is made in the neighbourhood of Cintra. That is a kind of claret. Do you know whether that is imported?—There are no light wines from Oporto, or from Lisbon either, imported into this country. I know the style of wine you mean. I do not think that sort of wine could be imported into this country, unless it had some chemical preservative in, or was fortified with spirit.

4377. You do not know that it is actually imported?—I should say it certainly is not imported. I have never heard of it being imported. It is a natural red wine of the country, and I have often tasted it there.

4378. I may, perhaps, tell you that it is exported to my certain knowledge; and I wanted to know whether it came to this country?—No, I do not think it does at all.

4379. It is, as a matter of fact, pretty largely exported to America, and it is often a consideration with the people who export it (whom I know something about), whether they shall brandy it, or whether they shall put salicylic acid into it. It is not possible for you to furnish the Committee with a list of the wines, where they might look for the evidence of salicylic acid?—I really do not think it is. I do not think any wine that is now imported into England contains it. There have been things said about salicylic acid, but no merchants would run the danger of prejudicing their wines by having salicylic acid put in.

4380. Is it not put in?—It is so easily traced that any chemist might trace it. Though it is not absolutely prohibited by law, we know it is prohibited in some countries, and that is sufficient. There is no necessity for it. It is not like the evidence I have just been hearing here in regard to milk; wine so very rarely goes wrong if it is properly made and treated.

4381. I suppose you have no experience of the factitious wines which are sent from Hamburg?—No, we do not sell them, but I have seen them.

4382. I do not suppose you sell them, but do you know anything about them?—No. I know there is a wine you hear of, a claret which has been offered to me at 6s. 6d. a dozen. I have seen that claret, which is made in this country. I do not know what it is made from. It does not have to pay any duty at all. I brought the matter before the Chancellor of the Exchequer, and suggested he should tax it when he was taxing our wines a little while ago.

4383. Do you think that is likely to contain salicylic acid?—I should think it is extremely likely.

4384. Do you know what the basis of that wine is?—No, I do not know at all.

4385. You have never heard?—No.

4386. Then you do not know where, or how it is produced?—I think it is produced somewhere on the banks of the Thames. It has been offered to us. I should not think it contains any grape juice. I have seen bottles of it labelled "St. Julien."

4387. (*Dr. Bulstrode.*) Could you tell the Committee something as regards the use of colouring matters in the wine trade?—Yes, let us take, for instance, sherry. They make a wine, called colour wine. Six or eight butts of wine are boiled down to one butt, and that produces a wine of very strong colour, which is used in the cases where the colour is wanted to be deeper. There is very little colouring matter used in wine.

4388. Do you know anything with regard to the use of alum in wines?—No, I never heard of it being used.

4389. What colouring matters are used with regard to liqueurs?—I cannot answer decidedly, but I should say burnt sugar of glucose.

4390. We hear of salts of copper, and picric acid being used?—No, not for a moment.

4391. Nor cochineal?—No.

4392. Are the wines which are sold in this country at 1s. a bottle, likely to contain added preservatives?—Not at all. In my opinion they are as pure and wholesome as the most expensive wines, and there is no reason why they should not be.

4393. Do they contain any added colouring matter?—There should not be any.

Mr. A. Gilbey.

16 Jan. 1900.

4394. In the south of France, Cette, and places like that, are there certain colouring matters, which are added to wines to make them appear other than they are?—Of course in those districts they make up a cheap wine for the use of the people which takes the same place as beer here, and is sold at a very low price, indeed. I do not know anything about that class of wine.

4395. I saw a list the other day, which was put into my hands, of certain substances which are used to make Burgundy, claret, and other wines, that is, to give them at any rate the characteristics of these wines?—As I say, the juice of the grape is so cheap, that there is no excuse to do that sort of thing. I do not think it is done, and those sort of wines, would never come to this country if it were.

4396. Do you have your wines and liqueurs examined both for preservatives and for added colouring matters?—They are constantly tested.

4397. Have those tests been for preservatives and for colouring matters?—I have told you we do not allow any preservatives nor any colouring matters.

4398. How do you ascertain that that which you do not allow is not put in?—From time to time we send them to be tested. Mr. Cassal tests our wines a great deal, and also Professor Dewar. We send to them constantly our cheap wines, and have them tested for our own benefit.

4399. Do they make a report to you whether those wines contain or not added preservatives, or added colouring matter?—We do not ask them to test for those particular things.

4400. (*Professor Thorpe.*) Is that test for anything more than the alcoholic strength?—Really it is for our own safety, but we do not know of anything. As I tell you we have never had a case of finding out anything. You see our wines are all over the country, in every village, and every town, and they are tested by every county analyst, so we should soon hear of it if there was anything wrong in them.

4401. You send them to Professor Dewar and to Mr. Cassal, but do you send them for any other reason than for the determination of the alcoholic strength?—No. We do it, as I tell you, really for our own safety. We have got into a system of sending them to these analysts, not that they ever find anything. It is not a question of the strength, because we can find that out perfectly well ourselves.

4402. Do they return anything else to you than the particular grade of alcoholic strength that those wines are?—Yes, they tell us what the wine contains, and so on, how much natural tannin, and so on, and as I tell you, I have never known a case where anything has been pointed out to us that was deleterious.

4403. (*Dr. Bulstrode.*) Do they put in as a fact, "no added preservative," "no colouring matter"?—No, I do not remember that that has been reported to us.

4404. So that really for all you know, although it is contrary to your instructions, it is possible that preservatives and added colouring matters may be used pretty extensively?—I really do not think they are. As I have told you, I do not think there is any necessity in doing it. The produce of the grape is naturally of a pleasant colour, and it is not desired to alter it.

4405. (*Dr. Tunnicliffe.*) Did you ever hear of the addition of mineral acids to wines?—No, never.

4406. You have never heard of such a thing?—No.

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* I find that my answers to the later questions put to me on the result of the analyses which are made from time to time of our goods were hardly correct, as on making inquiries I am told that in each case the wine tested is certified by the analyst as being free from foreign preservative or added colouring matters.

SIXTEENTH DAY.

Wednesday, 17th January, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. THOMAS CARRINGTON SMITH, called; and Examined.

Mr. T. C. Smith.

17 Jan. 1900.

4407. (*Chairman.*) You are a dairy farmer, living at Admaston, Rugeley, Staffordshire?—Yes.

4408. You are a member of the Council, and chairman of the Dairy Products Committee of the Central Chamber of Agriculture, and a member of the Staffordshire Chamber of Agriculture?—Yes.

4409. And you appear here, I think, on behalf of the Central Chamber of Agriculture?—Yes.

4410. I may tell you that we have received already full information from every source about the articles of dairy produce which are treated with preservatives at the present time, and we have a tolerably complete notion of the extent to which the practice prevails. What we would like to hear from you would be the result of any special observations on your part, and also the views of the Chamber which you represent, as to the use of these preservatives, and the necessity or expediency of restricting that use. I may mention that in order to save you trouble, because it is no use going over the same ground over and over again?—Are you in possession of the resolution that was passed by the Central Chamber of Agriculture?

4411. No, we have not received it?—I have in my hand a copy of the resolution passed, which is really a direction to Professor Long and myself, and I propose to hand it in. The resolution reads: "That this meeting is opposed to the employment of preservatives and colouring matters in articles of dairy produce whether British or imported; and that it be an instruction to the witnesses appointed by this Chamber to give evidence before the Departmental Committee to urge that as preservatives and colouring matters are believed to be deleterious to the health of invalids and children their use should be prohibited." That was the resolution passed by the Chamber which appointed us.

4412. If that were carried into effect, would that involve a serious interference with the dairy trade?—It would as now conducted; it would make illegal the colouring of cheese, and in that respect———

4413. I would rather divide the subject into two branches. Let us take the preservatives first, we will come to the colouring afterwards. It has been represented to us partly on behalf of the dairy trade, and partly on behalf of dairy farmers, that it would put a stop to a great deal of the milk traffic at present if the use of preservatives were prohibited; is that your opinion?—You are speaking now of fresh milk direct from the cow, are you?

4414. Yes, of the milk supply to towns?—My own experience is that it would not interfere with the daily supply of fresh milk from the cows. I have sent milk from Mid-Staffordshire into London for several years (I am now sending to Birmingham), and I was prohibited by my agreement with the West End Company, that

Mr. T. C. Smith.

17 Jan. 1900.

bought my milk, from adding anything to it, and I never did add anything to it.

4415. Rugeley is, I suppose, two hundred miles from here?—One hundred and twenty miles the station is, and I am four miles from the station.

4416. Did you send your milk up once or twice a day?—May I give you the result of last year's trading? When I say last year, I mean from Michaelmas, 1898, to Michaelmas, 1899. I sent the whole of my milk, excepting the Sunday morning's milk—and the reason why I found it after experience advisable not to send that——

4417. You sent it to London?—I sent it to London; to Willesden first, and then afterwards on a branch railway. Not once during that twelve months was there any suspicion of any sourness, or any hint of complaint made by my buyers, and I never lost a single pint of milk.

4418. Did you send your milk to one vendor?—I was under contract for the whole of it except the Sunday morning's milk; so the buyers had the whole of the year's milk between Michaelmas and Michaelmas, except Sunday mornings. Something may turn upon this point: I had previous experience that anything that went wrong with the milk was with respect to Sunday morning's milk; that arose from the fact that from my station, Rugeley, there is no Sunday morning train, only a midday train, consequently the milk of Sunday morning was not delivered to the buyers until the Sunday evening, and Sunday being a *dies non*, I take it the milk did not get into consumption until the afternoon of Monday.

4419. At what time did the morning's milk arrive in Willesden?—About a quarter past eleven, and it would get to the buyer about half past.

4420. It would get to the consignees, you mean?—Yes.

4421. Not to the retail customers?—No, not to them.

4422. Then the evening milk?—The evening milk I expect would be delivered during the night to the consignees; I believe that is the custom, but I do not know that. It would arrive later on, as it did not leave me till half past six.

4423. What is your milking time?—We milk in the summer here from five to seven in the morning, and from half past four to six in the evening. It is rather earlier than that in the evening of the winter.

4424. Then in every case the milk would be in the hands of the consignees within twelve hours?—It would, eliminating the Sunday morning's milk. I am now sending to Birmingham. I might say it is a matter of price really.

4425. There, I believe, the use of preservatives is prohibited in milk, is it not?—I have no knowledge of that, but it is a question of magisterial decision. I have read Dr. Alfred Hill's evidence, and I find that he found a considerable amount of preservatives in the Birmingham milk—9 per cent. I have here turning upon the same point of the inquiry upon which you are addressing me now, letters from three friends of mine, who sent their communications after the whole number had been received by the secretary of the Central Chamber. As they bear upon the question of the keeping of the milk, and of the consignment of the milk in large quantities, I should like to give you the information I have. I do not propose to use any names at all, but I could tell you the quantities, and I can tell you the towns.

4426. Before we leave the point of transit I should like to ask you this: Dairy farmers at a greater distance from London than 120 miles might find it difficult to send their milk so far, might they not?—I really cannot tell you that. For four months of the twelve months I only sent my milk once a day. It was a standing arrangement under contract with two West London firms that in November, December, January, and February, in order to save trouble on my part the milk was only consigned once a day.

4427. Of course those were the four cool months?—Yes they were. I am informed that not necessarily does the milk keep better during those cool months because I have been told—I do not know this of my own knowledge—that November is about as bad a keeping month as any we have. The temperature is not very low, and the atmosphere then is very humid. The keeping qualities of the milk are affected of course considerably by the temperature, and also to a very considerable extent by the humidity of the atmosphere.

4423. You were going on to read some information you had received?—I have three letters here from dairy farmers who send their milk to London. One sent last year 66,810 imperial gallons.

4429. Where from, please?—From Buckinghamshire. He gives the time of consignment and arrival; perhaps that would be interesting to you.

4430. I should like the distance in miles, because of course it is a question whether the railway companies do their duty also?—Then, I am bound to say I do not quite know. This particular one comes from the Aylesbury Valley. He says: "I use no preservatives. My milk reaches London at 11.8 a.m., and 8.8 p.m., and leaves here about 8 a.m. and 5 p.m."—it would be the produce of about 100 cows—"I have never had complaints of it not keeping sweet." He has never used a preservative.

4431. Did he use any cooling process?—Yes, that is absolutely necessary. He cannot go on an hour without a cooling process.

4432. A natural process, or a mechanical process?—We call the mechanism a refrigerator. It really is a series of tubes inside which cold water runs, and over which the milk itself flows. The milk is äerated to a very considerable extent, being distributed in a very thin volume over the whole of the apparatus, and it is cooled down by the water running inside the apparatus, and although we use the term "refrigeration," it does not approach freezing point.

4433. It has been stated before us that it is impossible for some farmers to command a supply of water for cooling?—That may be so, and probably was so to a very great extent last summer.

4434. Do you think those are proper premises or farms on which to conduct a dairy industry?—It is a *sine quâ non*, and I really cannot understand how men, who had no supply of water during last summer, were able to consign their milk any distance. I certainly cannot see how they could do it. On that point I should like to add that inasmuch as the cooling of the milk seems to me an absolute necessity for the trade, the farms which go into the milk trade for consignment at long distances must either go out of the trade or have a supply of water for cooling it. I would like to add also that I think that here in the large towns which receive the milk that we send from the country due provision ought to be made for keeping that milk sufficiently cool so that it may go into the hands of the consumer without taint.

4435. I suppose that is done to a large extent by large vendors?—We think so. We country consignors think that the large men take greater care at the consuming end than is taken by the small dealer. It is very easily done by having cool chambers. I should like to add also that I think it is quite feasible for the larger carrying railway companies to have better accommodation in their vans by means of a simple process of keeping their vans under a certain temperature. May I add the ideal temperature below which the consignors are asked to keep themselves?

4436. If you please?—It will not sound very remarkable; it is only 60 degs. Fahrenheit. We consider milk safe if it is reduced, we will say, to 60 degs., and I consider it safe myself for twenty-four hours provided that it does not——

4437. Do you find that the railway companies as a rule do not offer sufficient facilities?—I should hardly like to say that.

4438. You need not be afraid of offending me as a railway man?—It is not that, because I am going to confess that they have improved their facilities; but they have not yet given us cold vans. They have not yet used artificial means to keep the temperature of the van low, and it seems to me that it would be quite feasible to do so inasmuch as they have got power and steam on the very railway that carries the milk, but as a matter of fact, we have no reason to complain when we can send from Mid-Staffordshire into London milk for the whole year, and never have a single complaint nor a hint.

4439. Of course, you are on a main line?—It is quite true, I am on a main line, but I have between three and four miles to send it before it gets there. Shall I go on with the other two letters?

4440. If you please?—That first gentleman dairies about 100 cows. This next letter is addressed to me personally, and keeping back the name, I should like to read the letter:—"Dear sir, I am milking out now 500 cows, and send nearly all my milk to London, and I never have used any preservative or colouring of any kind, and

Mr. T. C. Smith.

17 Jan 1900.

I do not think they ought to be used in any form. It is greatly against us farmers and all agriculturists it being allowed to be used"—I suppose that applies to both—"and when used, as I hear they are, it is to back up dishonesty in most cases, and ought to be stopped, as it is against the producer and the purchaser, and only good, if to any, to salesman or middleman. Hoping you will use my ideas in any way you think best. I am now farming over 4,000 acres, and am sending over 200,000 gallons of milk yearly to London."

4441. What sort of distance is he from London?—The county is Berkshire; I am afraid I have not the distance, neither have I the time of consignment.

4442. Do you mind telling us the post town?—Faringdon.

4443. (*Dr. Bulstrode.*) That is on a branch line, beyond the Didcot Railway, is it not?—Yes. I am inclined to think the time is from two to three hours. I have the particulars you are thinking of in this next one, I think. I may say that I saw this gentleman personally; I met him by accident, and he afterwards sent me these particulars at my request: "We send daily to London the milk from some 1,500 cows, more or less. We never use any preservative summer or winter. The cows are milked from 4 to 6.30 a.m. and from 4 to 6 p.m., the morning milk reaching London at about 11 a.m., and the evening about 11 p.m."—with the exception of half an hour in the morning about the same time as mine coming from Staffordshire.

4444. Is that a farmer?—Yes.

4445. Of course, those 1,500 cows are not all his?—He has many farms, but he is entirely by himself—he is not a company.

4446. This is entirely his own stock?—Yes, it is his own stock—the man that consigns the milk is the owner of the cows, and farms the land.

4447. Now, as to other dairy produce—milk, I suppose, we may take to be the most perishable form, but how about cream? Can the cream traffic be conducted without preservatives?—I have no personal knowledge of that, but I should say myself that cream would be more liable to not keep—that is, to go tainted—than milk, for this reason—that it is richer; the cream itself is richer than milk, and as we know the richer a thing is the sooner it becomes tainted—*corruptio optimi pessima.*

4448. I suppose if you separated cream, it would not turn quicker than the skim?—There is just this—unless you use a separator—and a great many farmers do not—the temperature of the milk would have to remain at a considerably higher point than what we call the refrigerating temperature, and I am honestly of opinion that, unless the cream is kept down by artificial means below a temperature such as we apply to milk, the cream would taint rather quickly. I do not know, and I could not tell you from my own experience, how it would be, supposing the cream was always kept down at the ideal temperature that we think milk ought to be kept at. I really could not say.

4449. Have you ever made the experiment of separating milk and cream—in a separator, of course—and seeing which turns the sooner, the skim or the cream?—No, I have not.

4450. Supposing them to have the same keeping qualities, it is obvious, is it not, that if milk can be transported over long journeys, cream could also?—Provided it was always kept at a low temperature.

4451. No, I say, supposing that the keeping qualities were the same—I am assuming that they are—but I really do not know whether they are or not?—Are you assuming also that they are to be transmitted across the country under the same conditions as the milk?

4452. Yes?—You are putting to me a problematical question upon which I have really no experience.

4453. I understood you rather to imply that the use of preservatives was more justifiable in cream than in milk; is that so?—I did not say so. I said that my own judgment led me to conclude that cream kept under the same conditions as milk, would be more liable to taint than milk. I dare not go further than that.

4454. Have you anything to say on the subject of butter?—Excepting this; that as a butter-maker I never use any preservative, and I never use a colouring matter.

4455. Do you make large quantities of butter?—Not now; I used to do.

4456. The conditions of the butter trade have altered a good deal, have they not?—Very much so. I went into the new milk trade supply because I thought it was more remunerative than the making of cheese and butter.

4457. Now, turning to colouring matters, may we assume that colouring matter of various quantities is used in cheese, butter, milk, and cream?—I used colouring matter in cheese, but never in any other article of dairy produce. I made coloured cheese myself for twenty years, because of the enhanced price we get from the use of colouring.

4458. In certain districts, I suppose; may I ask what kind of cheese you made?—When I made cheese we called it the Derbyshire make, but the market it found was in South Wales and in the northern counties of England. It went through a factor. The mining districts, curiously enough, were the best customers for fine coloured cheese.

4459. Then it was purely to gratify the tastes of the consumer that you coloured the cheese?—Not precisely so—it was to bring a better income to myself.

4460. You would not have got the income unless you gratified your customer, would you?—That is so; it was a supply to answer a demand.

4461. What I mean is this—that you were not imitating a higher class article?—There was no doubt about it that everybody knew it was artificially coloured, if that is the meaning of the question. It was not intended to deceive; it was intended to supply a local demand.

4462. Was annatto the material used?—That was the only colouring matter.

4463. Are you acquainted with any of the substitutes for annatto that are used now?—By means of the returns that I have here, yes. We have a list here that shows us what other colouring matters have been used by those gentlemen who have given replies to our circular. The Central Chamber received replies from more than 100 people and firms giving the preservatives and colouring matters used.

4464. Is there a great variety of them?—There is a vast variety.

4465. Perhaps you could hand in the list?—Yes, I will do so. (*See App. No.* 11.) Annatto is the principal colouring matter. Forty-two returns show the use of annatto, and then the others are: Danish Butter Colouring, 5; Silver Churn, 5; Primrose Butter Colouring, 2; Oleo Butter Colouring, 2; Cowslip Colouring, 2; and Carrotine, Howarth Colouring Fluid, Tomlinson's Butter Colouring, Grated Carrots, Colouring XXX., Jersey Butter Colouring, and Buttercup Colouring one each.

4466. From whom did you get these replies?—From farmers and dairymen, but I can give you the proportions if you like to have them. Of the 64 replies which stated that colouring matters are used, 21 are from farmers and 21 are from either dairymen or dairy factors in the provinces, and 22 are from Metropolitan dairymen. Of the 46 replies from persons who do not use colouring matters 31 are from farmers and 11 from dairymen in the provinces, whilst only four of the replies of the Metropolitan dairymen state that colouring matters are not used.

4467. I suppose these patent colourings are largely pressed by agents through the country?—I do not think so particularly.

4468. How do they get then into the hands of farmers and dairymen?—Having only used annatto, and not calling to mind having been asked to use any other, I cannot tell you.

4469. No, but you are acquainted with the ways of farmers, and it is not likely that a farmer would sit down and write for "carrotine," or one of these things, unless it were brought immediately under his notice by a local agent?—Or having seen it advertised in a newspaper—that is so.

4470. Why should he prefer these substances to annatto?—I think the replies from farmers are very nearly wholly confined to annatto.

4471. (*Professor Thorpe.*) Is it not the fact, however, that persons attend weekly markets and local dairy shows pushing these substances, both colouring matters and preservatives?—Yes, I think I may say when I have attended a dairy show, especially, we will say, this one in London, I have frequently had leaflets thrust into my hands, but I am afraid I do not read them.

4472. That is the kind of organisation by which knowledge of these things is distributed?—I think that is so.

4473. (*Chairman.*) Then as to butter, you cannot speak from experience, I think?—I never used preservatives in butter, and I never used colouring, but here I have replies in regard to the colouring.

4474. Colouring in butter?—In cheese, butter, and milk also. Seven farmers and four provincial dairymen or dairy factors colour cheese; sixteen farmers and sixteen provincial dairymen or dairy factors colour butter.

4475. This is sixteen out of 100 or out of what quantity?—We have 64 replies out of 100 saying that they use colour.

4476. (*Dr. Tunnicliffe.*) Is it 16 out of 64; I do not quite understand yet?—I was dividing them into farmers and dealers afterwards. Sixty-four used a colouring of all sorts—farmers, dealers, and everybody else; then analysing them as to whether they are farmers or dealers, it comes out as I have stated. Forty-six do not use colouring matters at all.

4477. Among the 46 who do not use colouring matter, would there be any cheesemakers, or would they simply not use the colouring matter because they did not make cheese?—I have got seven farmers who colour cheese and four provincial dairymen or dairy factories who make cheese with colours.

4478. I think we would be quite content, without troubling you with every minute detail, with your opinion founded on your experience that the use of colouring matter in cheese is tolerably general, is it not?—Yes, and the farmers themselves use the colouring sometimes in accordance with the demand of the market, that is to say, if the price of coloured cheese goes up a farmer would colour his cheese, whereas if the coloured cheese was not in demand, he would cease the colouring. These localities are perhaps exceptional. Cheshire and Leicestershire are the two counties where coloured cheese is common.

4479. There are other counties where they colour cheese?—It is so, of course, but I say common.

4480. The practice is universal in the North, is it not?—I should not say so.

4481. "Wiltshire," "Gloucestershire"; however, we need not go into that. There is a slight difference in the practice of colouring butter, is there not, inasmuch as butter is not coloured in summer and is coloured in winter?—I never had any difficulty when I was a buttermaker in getting my butter the right colour even in winter. There were certain courses of action taken to keep the colouring during winter, such as would be acceptable to the public taste. One would be having a sufficient proportion of newly-calved cows, and the other would be giving articles of food which had an effect upon the colouring of the milk.

4482. Such as bean meal?—Or maize meal. There are certain foods that have a considerable influence during winter on the colour of the butter. I may instance mangolds (which help to give a very white milk), and decorticated cotton cake, although giving a rich milk gives a milk of a pale colour. My own experience is that maize meal as a food during winter gives richnesss of colour to milk more than any other meal that we use. The breed of cows is another thing to do with the colour of the butter.

4483. Really?—I mean the kind of breed of the cow which produces the milk.

4484. That has something to do with the colouring of butter?—A great deal.

4485. That shows how experts differ. I put that question to a gentleman yesterday, sitting where you are, and he told me from wide experience that it had nothing whatever to do with it?—That an Alderney and a Guernsey cow give the same colour as other breeds?

4486. Precisely?—Where has he been living?

4487. What are the views of your Chamber as to the restrictions, if any, necessary to be imposed in respect of colouring matter?—I come here under instructions from the Chamber against all colouring of dairy produce, and against the use of any preservative. The resolution which was passed at the annual general meeting of the Central and Associated Chambers of Agriculture relates equally to the question of colouring and to the question of preservatives. The Chamber would like to see the use of preservatives and colouring matters both in home and in imported produce entirely prohibited. It is obvious that any such prohibition should apply all round, as it would be a manifest injustice that foreign produce should contain colouring matter if those were prohibited in home produce. In fact, as a matter of justice, any restrictions that may be placed upon the colouring of articles of food must be made to apply equally to imported and to home produce, and must also apply to margarine as well as to dairy produce. Personally I do not think that the question of preservatives and colouring stand quite on the same platform.

4488. It would have rather a serious effect upon certain branches of dairy farming in different districts, would it not?—As representing my own Staffordshire Chamber of Agriculture I am bound to say that the feeling locally of all the Staffordshire farmers would be against the prohibition of the colouring of cheese, but they have a very strong opinion that the colouring of milk should be prohibited. They hold that the colouring of milk is simply a practice in order to make the article appear richer than it really is. With respect to the colouring of cheese they hold that the public in no way can be or are deceived, inasmuch as they know that the colouring is brought about simply for the sake of the market, and it is sold as coloured cheese, whereas they hold that the consumer of milk is deceived by having coloured milk presented to him for sale, and that there is no other object in colouring milk except fraudulent sale.

4489. And their objection to the colouring of margarine would proceed on the same ground?—It would so.

4490. (*Professor Thorpe.*) What is the membership of the Staffordshire Chamber of Agriculture; how many members are there?—About 200.

4491. They are mainly, I presume, farmers?—They are.

4492. And engaged in milk supply?—A considerable proportion in cheese-making—but more every year in milk supply.

4493. Can you approximately tell the Committee what volume of milk these gentlemen would be dealing with in the year who have subscribed to that resolution?—Are you alluding to the resolution against colouring?

4494. Against preservatives?—The whole of those in Staffordshire who are interested in dairy farming who were represented at the Chamber were unanimous in their vote against preservatives, but not for the prohibition of colouring.

4495. We will take preservatives. I want to know if I can get from you what volume of milk approximately is represented by that resolution which prohibits the use of preservatives in the milk?—I could not give it you.

4496. (*Chairman.*) Could you put in the number of cows approximately?—No. I really have no data as to how many of us sell milk and how many make cheese.

4497. Could you not approximately tell then the number of heads of cows?—No. I can speak of some of my neighbours' and my own.

4498. (*Professor Thorpe.*) Of course, you understand the object of my question is, if I can, to elicit the volume of trade which is represented by that resolution; could you supply the Committee with that information?—I could afterwards.

4499. (*Chairman.*) May we take it that it is considerable?—Very considerable. My own is 36,000 gallons of milk, and I can call to my mind several neighbours who would be pretty much in the same way; it would be many hundred thousand gallons.

4500. Yours is 36,000 gallons in the year?—Yes.

4501. About 100 gallons a day?—Yes, in my own case, and I can call to mind a good many others who send approximately the same quantity. I am not sure that I could get a correct answer, but I will endeavour to get a correct answer; I think I can manage.

4502. (*Professor Thorpe.*) Of course, it must be only in the nature of approximation in any case, but what we want is merely a rough idea of the volume of trade?—Your question asks me to discriminate between the cheese makers and the milk sellers, does it not?

4503. What I immediately want to know is what volume of milk is represented by that resolution according to which preservatives are not to be used?—I quite understand; I will try and get it, and I can get it in the course of a week or so. I will get it through the secretary. It will be rather difficult, because at certain periods of the year the same men change their practice—that is to say, they sell the milk during the winter and make cheese during the summer. You may take it from me that there would be a very large quantity of milk that is sent from Staffordshire; some of it would go to Birming-

Mr. T. C. Smith.

17 Jan. 1900.

ham, some to Manchester, some to London, but a very large quantity comes to London.

4504. Can you tell us, from your experience as a large dairy farmer, what are the conditions which tend to the preservation of the milk, other, of course, than preservatives; what do you aim at securing in order to keep your milk such that it will travel safely?—Cleanliness and coolness.

4505. Perhaps you might say, in a little greater detail, what you mean by cleanliness—what do you do to secure cleanliness?—I will answer that question as well as I can. We keep the cows clean, and the sheds clean, and we pass the milk through three or four different sievings. By my own device we have a receiving vessel above the refrigerator, the receiver being not far from the shape of this piece of paper, rectangular, a sieve which is not in the bottom at all, but is on the side *here*, so that there is a hollow space in the receiver which would receive any sediment that had passed through the first sieve. The milk goes through an ordinary sieve in the first instance, then goes into this receiver, passes through sieves in the side of the receiver, runs over the refrigerator and then falls on to the milk churn, over which again I have one of the finest sieves I can buy, and over which again I have a piece of muslin. Granting that there is as much cleanliness as is procurable in the milking of the cow, my milk afterwards gets sieved three or four times; and I must honestly confess that on the very fine muslin which is on the top of a very fine sieve over the churn, I very often see some slight sediment; so I am continually collecting a little, and I pride myself on saying that I have sent my milk away as clean as it can possibly be got.

4506. I gather from that answer that it is some suspended matter in the milk which is connected with its turning sour?—I cannot give you any chemical reason why it is so, but I think common sense leads one to the conclusion that, whatever impurities an article may have in it, the more liable it will be to taint; and if it were not even so—that is to say, if the milk did not become tainted because of its extraneous impurities, they would be objectionable to it as a food if they did not affect its keeping qualities. I strive to get my own milk as clean as it can possibly be kept, and I have not much doubt myself that the cleanliness in the milk itself and all its surroundings has a good effect upon its keeping qualities; but I should put coolness before that, as far as the keeping is concerned.

4507. The cleanliness, you say, may be of two kinds—the uncleanly matter might be soluble, or it might be suspended; your system merely takes out anything in suspension?—By soluble, do you mean something intrinsically in the milk itself as yielded by the cow?

4508. Or something which gets into it in some way or another, I do not profess to know how?—I think the dry particles that would be flying about in the shed which would come to the milk during its handling, while it was milked, or being conveyed to the refrigerator, would not be soluble.

4509. Probably not?—I think they would be insoluble.

4510. However, what I have gathered from your answer is this, that in your opinion it is desirable to strain the milk efficiently in order to conduce to its keeping character?—Yes.

4511. That is your experience?—Yes, but I do not put it first—I put coolness first.

4512. Never mind—after the coolness?—Yes.

4513. I should like, if I could, to get from you whether there is anything in this practice that you advocate which precludes even a comparatively small farmer from adopting the same process?—The practice of straining, do you mean?

4514. Or whatever other practice you follow?—It would not be difficult for a small farmer to adopt the practice of sieving his milk frequently. The sieves are very inexpensive, and I take it that every farmer who is in the milk trade ought to or does refrigerate. I am not sure that I am right, but I know that all the milk buyers that I have had to deal with make it a *sine quâ non* that the refrigerator should be in order and constantly used.

4515. Then, speaking generally, you think that if farmers sufficiently cooled their milk, and sufficiently strained their milk, they might be independent of the use of preservatives?—I am quite sure they are, speaking from my own experience and the experience of my neighbours. 36,000 gallons of mine came up to the West End of London during that exceptionally hot summer of last year, and not once was there a hint of any of that milk having become tainted in any way, even to the extent of "Mind and be careful about your cooling"—and it is a fact that not once was a representation made to me from my West London buyers here with respect to the slightest doubt about it—with the thermometer where we know it was.

4516. Now, I suppose that there will be very little difficulty in requiring the farmer to efficiently strain his milk?—You would find a greater difficulty in that than you would in making them provide the refrigerator, because the refrigerator is there to answer for itself always, and the sieving is not.

4517. I was coming to the refrigerator; we have been informed that one of the greatest difficulties that a number of farmers would have is obtaining a sufficient supply of cold water?—I am afraid that is so.

4518. The mere mechanical arrangement of sieving, it seems to me, would be comparatively easy to provide?—Yes.

4519. But an efficient and plentiful water supply might be a very great difficulty?—I do not wish to be misunderstood. The refrigerator implement is easy to supply, but the water is very difficult. The instrument, the refrigerator, is very easily got, but the supply of water in such a season as last year I grant was a very difficult matter.

4520. But I also gathered from your evidence in chief that in your opinion a person who is not provided with a sufficient water supply ought not to be in the milk trade?—That is so. I have a strong opinion to that effect.

4521. The only other question I should like to ask you relates to the use of colouring matters. Was the resolution which was passed relating to the use of colouring matters in dairy products aimed indirectly at margarine?—The resolution here, read at the Central Chamber, certainly comprehended margarine. I do not think it was entirely owing to the fact that the Chamber is opposed to the colouring of margarine that the resolution was so drawn, but that it was drawn so as to include margarine I have no doubt.

4522. So the primary object of it aimed at margarine?—I cannot answer that question, but I should say not. During the course of the discussion there was a specific amendment that the words should be added: "To prohibit the colouring of margarine"; that amendment was negatived, and the words were not added.

4523. (*Dr. Bulstrode.*) Are you a member of the Rural District Council or the Urban District Council of the locality in which you live?—No, I am not; but I am a member of the County Council.

4524. Have you been a member of the District Council?—No, I have not been a Guardian since the passing of the District Councils Act.

4525. But you were before?—I was a Guardian before.

4526. Then you would probably know that it is incumbent upon Local Sanitary Authorities to enforce the provisions of the Dairies, Cowsheds, and Milkshops Order?—Yes, I am quite aware of that.

4527. And you also know that the provision of Section 8 of that Order is as follows: "It shall not be lawful to occupy as a dairy or cowshed any building, whether so occupied at the commencement of this Order or not, if the lighting and ventilation, including air space, and the cleansing, drainage, and water supply thereof are not such as are necessary or proper (*a*) for the health and good condition of the cattle therein, (*b*) for the cleanliness of milk vessels used therein for containing milk for sale, and (*c*) for the protection of the milk therein against infection or contamination"?—Yes, I am quite aware of that.

4528. Surely if this Order were duly carried out there should be no difficulty in bringing about the cooling methods which you advocate?—Always supposing the supply of water was not cut off by drought.

4529. Of course those are quite exceptional circumstances—exceptional drought, perhaps, we need hardly consider?—We have had three consecutive summers when the supply of water was very difficult.

4530. In which, I take it, it was illustrated that the Local Sanitary Authority had failed in providing a proper water supply to their district?—I myself agree with the Section that you have read, but I think a Local

Mr. T. C. Smith.

17 Jan. 1900

Authority would pass over as a visitation of God such a local deficiency in water supply, and would not take any steps.

4531. But you would agree that if this Order were enforced throughout the country, an enormous amount might be done towards improving the conditions of our milk supply and the keeping power of the milk?—I have no doubt about it if it were carried out with reference to the drainage, the ventilation, and the lighting of the sheds.

4532. With regard to what you tell us of refrigeration, is it necessary to have ice in connection with the refrigerator?—Not at all.

4533. Simply cold water?—That is all.

4534. Do you think that that is a very serious difficulty in ordinary times?—No, except in certain localities where the supply of water is very deficient in volume.

4535. Where, therefore, it should be improved?—Yes. May I tell you what has, I know, been done—in fact, it has been done by myself—and it has been done quite successfully? My milk is refrigerated simply by catch-water. All the buildings are spouted into a large subterranean tank, and I find that water quite efficient.

4536. You find it always quite cool enough for your purposes?—Yes, the tank is very large and subterranean, and free from any action of the sun. The water is got from the heavens over a very large tract of building, which is never contaminated by a pigeon or anything of that kind, so we get as pure water as can be gathered from rainfall.

4537. Are the roofs never contaminated by birds?—They are by sparrows, it is quite true, but nothing bigger. I am simply pointing out the fact that it is possible to meet that deficiency of spring water. Do not run away with the idea that that water is ever used for any drinking purposes or in connection either with the milk or for any cleansing purpose, because we have a sufficient supply of spring water to cleanse all our vessels.

4538. The water so used for the refrigerating vessels is not in any way in contact with the milk?—It does not come in contact with the milk or with the milk vessels under any circumstances, so that the water difficulty can be met.

4539. I see the distance of Faringdon from London is about seventy miles, and that the trains are mostly slow and take about 2½ hours?—Yes, I expect that would be so.

4540. You said that you were not aware that the sale of preservatives was pushed very much. Were you at the Agricultural Show at Liverpool this last year?—No.

4541. If you had been I think you would have seen that they were somewhat extensively advertised. Were you at the last Agricultural Show at Islington?—The dairy shows?

4542. Yes?—I was there.

4543. Did you see large letters of advertisements of preservatives?—Yes, and "Imitation Milk."

4544. Did you have pamphlets about those pushed into your hands as you walked about?—Yes, in connection with the imitation milks especially. I did not give a list of the preservatives that we got returned to us.

4545. (*Chairman.*) We should like to have that?—I propose to hand them in.

4546. Have you any observations to make upon that list?—I have simply to say that they are boracic acid or materials that we think are largely composed of boracic acid. It is a very long list, and some of them I have no knowledge of. Sixteen return arcticanus; I confess I do not know what arcticanus is, but I am told it is a preparation of borax in some form.

4547. (*Professor Thorpe.*) I think, perhaps, it may save some trouble if I tell you that, as a matter of fact, we have a very complete collection of all those preservatives from all parts of the country, and we know their composition. I should like, however, to see the list, to see whether by any chance there is any one which has not already been brought to my notice?—Very good (*handing in return, see App. No.* 11). I might state that arcticanus, borax or boracic acid, glacialine, preservitas, and formalin are at the head of the list.

4548. (*Dr. Tunnicliffe.*) Do you think the prohibition of preservatives would have any effect upon the price of milk?—If it had any effect at all I think it would probably for the time being restrict the supply; if there was a legal enactment against the use of preservatives it would for the time being take out of the public supply those people who have been in the habit of using preservatives up till now. After an intermediate time I think probably it would have no effect.

4549. Then you think it might raise the prices for a short time temporarily?—I think it probably would just while people accommodated themselves to the change in the law. I have a very distinct opinion myself, and it is carried out by these returns, that the use of preservatives is made seldom by farmers and often by dealers. Our returns here from the Metropolitan dairymen give twenty-two out of twenty-six as using preservatives. Of course, I know nothing about the dealing myself; I am only speaking now from my own experience as a producer. I have no hesitation in saying that the suppliers of milk need not use preservatives at all in this small island of England. It is not necessary that the very farthest parts of this island from London should send their milk to London; they have other large centres of consumption to which they can consign their milk, and I do not think any public hardship would accrue.

4550. You do not send any milk away on Sunday afternoons, as I gathered from what you said?—Yes, I do.

4551. Then I did not gather it correctly?—It was the Sunday morning's milk that I did not send to London. I always sent my Sunday night's milk to London, because that got into consumption on Monday morning. Now I am sending all of it to Birmingham.

4552. You are not sending any at all to London now? —Not since Michaelmas. It is not unlikely I may be sending to London next year. It is a question of supply and demand. I got a better price—that was the long and short of it.

4553. (*Chairman.*) You have told us that your Chamber are distinctly opposed to the use of preservatives, and wished either regulation or prohibition, but you have not told us why; what is their motive in objecting to the use of preservatives?—It is difficult to say, but, speaking for myself, as a family man of considerable experience, I think the use of preservatives in milk is distinctly prejudicial to health.

4554. I ask you to speak for the Chamber?—To say what the other people voted for? Whether that was present to their minds or not I cannot tell. It may be that this was present to their minds—that the trade in new milk might be improved by the fact that the people who use preservatives would send milk a great distance, say, and use the preservatives because they think it would be necessary—would be eliminated from the trade—and the price of milk would be enhanced for the time being by the abolition of the use of preservatives. I think it would have a temporary effect.

4555. It has been suggested to us that the objection on the part of the Chamber is based entirely on a desire to exclude foreign and Colonial produce?—Surely that could not apply to new milk?

4556. No, I was speaking of preservatives generally; it would apply to butter no doubt from Australia?—Clearly. It would not apply to Danish butter, because the prohibition of preservatives is absolute in Denmark, and all the Danish butter we get here is protected by the State from having an addition of preservative made to it; you know that, I suppose.

4557. We have had it repeatedly in evidence; but it would exclude Normandy butter, Colonial butter, and South American butter?—I am told it would exclude some of the Irish butter. I heard an Irish speaker at the Dairy Show say that they dare not send to Birmingham their Irish butter which has had a preservative added to it, because they would be prosecuted and fined. I was surprised to hear him say so, but I heard him say so.

4558-59. Then, whether you speak as a family man or as representing the Chamber, you are equally of opinion that prohibition, and not notification of the presence of preservatives, is desirable?—If I may speak only for myself I would say that I do not think the use of preservatives in butter would be so objectionable as the use of preservatives in milk. Perhaps I may add that I am in the constant habit of eating Colonial butter in my own household, and have been for six or eight years. I think the British consumer now buys in the cheapest market, and never minds how he arrives at it; I honestly say that. He may not say he does it, but he does it.

4560. Then you, at all events, are not open to the suspicion of being actuated by Protectionist motives in

Mr. T. C. Smith.

17 Jan. 1900.

what you have told us?—I am the son of a free-trade farmer and have been a free-trader all my life.

4561. (*Dr. Tunnicliffe.*) Have you ever had it suggested to you, or had any personal experience, of preservatives in food having caused injury to health?—Not in dairy produce, but, if I may be allowed to say so, I have a strong opinion that the use of preservatives——

4562. I was rather asking you for facts, and not for opinions, in this individual instance; you have expressed your opinion, and I was asking if you could substantiate it by any fact?—My own personal experience is that I have been unwell several times, when I have attributed the illness to tainted meat or game—a taint of which I have not been aware at the time. I have an opinion that preservatives do—not only that they may—take away the evidence of the taint, but do not destroy the taint. I have a very distinct recollection of being ill; I had been at a friend's house dining, eating game, no taint of which I discovered at the time, but I was ill afterwards, and from inquiry I made I came to the conclusion that my illness was attributable to the grouse, which had no outward sign of taint.

4563. Do you know that a preservative had been added to that grouse?—I do not know that, but I do know that it is a habit of cooks to use such articles in cooking.

4564. In the instance of the meat which you gave us, do you know that preservatives had been added to the meat?—I do not know it, I only heard of it. I will hand in these various returns relating to preservatives and colouring matters, which you see give in very full detail the quantities used by various persons, without, however, disclosing their identity. (*See App. No.* **11.**)

Mr. J. Long.

Mr. James Long, called; and Examined.

4565. (*Chairman.*) You are a member of the Council and a member of the Dairy Products Committee of the Central Chamber of Agriculture?—Yes.

4566. And a member of the Council of the British Dairy Farmers' Association?—Yes.

4567. You were formerly Professor of Dairying and Dairy Farming at the Royal Agricultural College, Cirencester?—Yes. I am a farmer, too, I should like to add; I farm myself.

4568. You have heard Mr. Carrington Smith's evidence?—Yes.

4569. You also appear on behalf of the Central Chamber of Agriculture?—I do.

4570. Do you agree, in the main, with what he has told us?—There might be details which I could supplement or subtract something from, but very slight details indeed, and in the main I agree entirely.

4571. Do you agree with him in considering that the dairy traffic at large, and the milk traffic in particular, could be carried on without the use of preservatives?—Certainly.

4572. That an ample supply may be maintained in big towns by the simple use of proper precautions?—I do. I go further than Mr. Carrington Smith. In case preservatives were abolished, I should say that the farmers could produce the milk more than is required, but that difficulty would arise in towns in which the large buyers would be compelled to protect themselves by building some cooling chambers or refrigerators in case they found it necessary.

4573. We understand from Mr. Carrington Smith that some, at all events, of the large buyers object to the use of preservatives, or at all events bar their use before the milk comes into their hands?—Yes, they do, and some do not use them.

4574. Therefore the assumption is, what one tradesman or company is able to do other tradesmen and companies can do also?—Yes.

4575. Are there any means of extending the keeping powers of dairy produce beyond the natural refrigerating process that we have heard about?—May I take my evidence as I laid it down?

4576. If you please, but I do not want to take you over the same ground; you have corroborated generally Mr. Carrington Smith's evidence, and it would suit your convenience and ours also if we do not repeat that?—I have taken considerable pains to get circumstantial evidence, and I will not repeat anything that has been said by Mr. Carrington Smith; but I should like to give you my evidence if you will permit me to do so.

4577. We should like to have it in your own way?—I have in the first place facts from a large north country dealer, a milk supplier upon a very large scale, a wholesale and retail man. He is a man I know very well, and his premises I know very well too. He tells me that he has for thirty years been able to supply his customers with milk without preservatives, and that he can always keep his milk in the hottest weather from twenty-four to thirty-six hours if it is well cooled.

4578. In what town is that?—That is in Lancashire. By "well cooled" he means below 60 degrees Fahrenheit. He adds to that—and I am giving you the opinion of a man of very wide experience indeed—that where preservatives are needed is when the milk is not properly clean, in other words, when the place is not kept clean. The next man is the managing director of one of the largest companies in England, possibly the largest company out of London. He says: "If cooled to 54 degrees the milk will keep twenty-four hours perfectly; if it is cleaned by separation and then cooled, it will keep thirty-six to forty hours in the hottest weather." Now I want, with your permission, to illustrate what I mean by this. This company, with large numbers of shops in different northern towns, are putting up plant to clean the milk. The object is to carry out what they know to be true in practice. By passing the milk through the separator they remove the dirt, and this is a sample I have brought you which was taken this morning from six gallons of milk (*handing in specimen*). That is a sample of the slime that comes from milk cleaned by the aid of the ordinary separation process. My point is—and it is the same point that is raised by this particular firm or company—that milk which is not clean cannot possibly be expected to keep.

4579. What quantity of milk is that taken from?—From six gallons. I made some experiments some time ago, and in a discussion at the Farmers' Club I gave the results of a calculation based upon the experiments. I believe that an ordinary large consumer of milk—I do not mean a London consumer, but a person who takes a fairly good quantity of milk a day—consumes in the course of the year four ounces of that slime. I want to call the attention of the Committee to this paragraph by Dr. Leffmann, which I will hand in. Dr. Leffmann says: "Processes of digestion are allied to processes of decomposition, in so far that the latter are frequently preceded by transformation under the influence of ferments. We may infer, therefore, that whatever prevents putrefaction must at least delay digestion." That is a sort of corollary upon the presence of that material in milk. Then the next firm—and I refer now to a large London firm, wholesale and retail—say: "We cannot say exactly what quantity of preservative is needed." This firm uses preservative. My point here is to show you from the evidence of this firm—and I could adduce others—that it is used promiscuously and carelessly. I have seen it done myself repeatedly, and from year to year. They do not take any precaution as to whether they use an ounce to a churn of 17 gallons, or three ounces to a churn. This firm believes, when they are put to the test, that two ounces per 17 gallons should be sufficient—that means 56 grains to the gallon—and that it should be only used in very trying weather. Then the next evidence is from Ireland, from a wholesale and retail manufacturer there whose premises I have been to and whose work I have seen. These people say that milk in their experience will keep if well cooled twenty-two hours during the hottest weather if the vessels are clean.

4580. Is this a distributing agency only, or a creamery?—This is a creamery and distributing agency. If preservative is used, they find one-twentieth of an ounce per gallon is sufficient.

4581. Do they send out cream in jars?—They send cream and butter to England—principally to England.

4582. Can they send cream without preservatives?—That I do not know. Then the next is a large London company who tell me that in the whole of their trade for many years they have used no preservative at all; that if the milk is properly cleaned and properly cooled

Mr. J. Long.

17 Jan. 1900.

it will keep under the worst conditions sufficiently long to enable the customer to be provided. The next is also from a North of England retail milk salesman, also on a large scale. I have been to his premises. This man says: "During the hottest weather my milk will keep twenty-four hours, and if kept at 60 degrees during the first twelve hours it will keep for thirty-six hours." This practice he has adopted for twenty years; I think that is rather unusual evidence.

4583. If kept at 60 degrees for the first twelve hours it will keep for thirty-six hours?—Yes.

4584. Thirty-six hours in all?—Yes; that is in the hottest weather. That has been his practice for twenty years. Then a Scotch gentleman who produces largely and retails in Glasgow, sending his milk there himself (about twelve miles), says: "I find it is entirely a matter of cleanliness and temperature. No difficulty is experienced by me in keeping my milk twenty-four hours in the hottest weather." Then the next is from a gentleman who has been director of a dairy school, and who is now in business for himself. This gentleman says: "At such-and-such a place the milk kept twenty-four hours when cooled to 60 degrees. At the next place it kept thirty-six hours after cooling at 56 degrees; indeed, it will keep still longer, and it almost refuses to go sour at all."

4585. That is rather a strong statement?—It is. It was not meant for publication, nor was it meant for evidence; but he is a man of very great accuracy and great attainments. The next is from another farmer, a retailer in a Midland city. This gentleman has used a preservative, but owing to the tuberculosis scare he was induced to pasteurise his milk, and he has since sold all his milk cooled after pasteurisation, and has satisfied his customers.

4586. What district is that in?—That is a city in the Midland counties.

4587. (*Professor Thorpe.*) Is that a large milk supply?—Very large indeed; he is one of the largest retailers I know.

4588. The whole of whose milk is pasteurised?—The whole of it is pasteurised. I will give you his name, of course, with pleasure. This gentleman adds this remark, which is very pertinent: "Milk sent out and returned is not fresh, and ought not to go out again, especially in hot weather." I would add to that that milk does not all keep alike, the reason being that the water supply may be deficient, that the food varies, brewers' grains contributing, in my belief, to the non-keeping quality of the milk, and then want of cleanliness first in the cow-house, next with the cows, thirdly with the men, and fourthly with the milk vessels. The next is from South Devon—a gentleman who has a very large farm, between 1,000 and 2,000 acres, and produces butter, cream, and milk for supply in one of the large cities of Devonshire and for dispatch. He says that his milk is cooled from 55 to 60 degrees immediately after milking, that it keeps from thirty-six to forty-eight hours in the hottest weather, and that when the weather is sultry it is scalded at a higher temperature. This milk is all scalded. He has no trouble at all in keeping his cream—clotted cream or butter made from clotted cream—at any time of the year.

4589. (*Chairman.*) It is scalded, I suppose, within a few hours of the milking?—Yes.

4590. And then cooled down at once?—It is scalded about twelve hours after milking.

4591. And cooled down at once?—No, it is not cooled down. It is worked upon the Devonshire system of scalding and raising clotted cream. It is taken to the cool dairy for clotting, and allowed to remain there.

4592. Is it cooled down immediately after milking?—No.

4593. Is it left to cool naturally, and the cream to rise?—It cools naturally. The cream would not rise properly if it was cooled immediately after milking.

4594. Have they introduced separators into the Devonshire dairying?—Yes, but not very largely. The next question I wish to speak upon is the importance of sterilisation, and I do so because I myself have sterilised for a considerable time. I designed by the aid of a friend who had aided me in making a similar experiment, a sterilising apparatus, and we have sterilised milk in bottles for some two years. Therefore, I have experience of what can be done by sterilisation. If you will allow me I will give you any details.

4595. If you please?—The milk is in the ordinary way passed through a sieve, a specially and carefully made sieve in this case, because it is attached to the apparatus; it is siphoned into the bottles, and then the bottles are placed in the sterilising vat with the stoppers not fastened, but just hanging over the mouth of the bottles. The next thing is to seal down the lid; we have a lid with a number of screws and nuts; it is screwed tightly, and the steam is gently turned on; the process is continued for half-an-hour at a temperature of 212 to 213 degrees Fahrenheit, or thereabouts, the waste steam passing out, of course, of a specially made vent. Then after the half-hour has elapsed the lid is removed, and the assistant, with heavily gloved hands, stoppers all the bottles. Of course, there is no apparatus for doing this that we use; there is one in the market, but it is not quite so satisfactory as one could wish. The bottles being stoppered, the lid is put down at once, and steam and cold water are gently introduced, the two combining. It is essential to cool as rapidly as possible, but if you run the cold water into the vat when the bottles are very hot they crack, and so it is done gradually. Then in half-an-hour's time the bottles are cold, and then the milk will keep, not for any length of time, but for any reasonable length of time.

4596. Do I understand that this is a process of handling the milk?—It is the ordinary sterilisation of milk.

4597. Where is this carried out?—At my own place in Hertfordshire.

4598. For supplying the market?—Yes.

4599. (*Professor Thorpe.*) And on a large scale?—No, not at all.

4600. (*Chairman.*) But, of course, it is in some places carried on on a very large scale?—Yes, it is—on a very large scale.

4601. Do you see any objection to the use of bottles for the milk supply of towns?—The only difficulty is that consumers do not clean them properly, and so they give you a great deal of trouble; you have to clean them when they get back. Of course, that is a matter for the farmer or the person who conducts the trade to see after.

4602. But there are some large towns in which the trade is conducted entirely in bottled milk, are there not?—Yes, there are indeed.* The first time I saw it properly conducted was in Switzerland, in a large factory near Berne. Some four years ago, or five years ago, the Dairy Farmers' Association went to Switzerland for their annual Conference; I was chairman of the year, and I asked the chairman of the factory to take us over and he did so, and showed us the whole process, but we were not allowed to understand it altogether.

4603. One great advantage of it is, is it not, that milk when being taken from house to house cannot be tampered with?—That is a great advantage.

4604. The bottles are a fixed measure and sealed?—Yes. Another advantage is that you can deliver once a week instead of fourteen times a week; you can deliver a week's supply, and that is a great convenience. The next point that I should like to urge is the fact that milk is drugged three times over. I mentioned this at the Chamber in the discussion I think, and some people do not think it is true.

4605. That is to say, it may be drugged three times over?—It may be, and it is. I have proof of it, and I should like to state that fact in evidence, that I have proof that milk is not only drugged by the farmer, and by the wholesale firms, but also by the retailer. I have a letter here that will give you a proof of the facts. Next, I should like to add that I myself send milk to London.

4606. Are you going to put in the proof?—I will read it to you or show you the letter if you like; I cannot part with it, as it is a private letter.

4607. Of course, that is a very important statement; if you have evidence to show that milk has been treated in that way we should like to have details of the case?—I will give it to you.

4608. It will be no use to us unless we have it on the notes?—I could not possibly do that.

4609. You see our position, our Report will have to be founded on the evidence laid before us, and of course if you wish us to be convinced, in that case you will have to read it to us—without mentioning the name. You are able to assure us that you are satisfied of the correctness of it?—Yes, I am perfectly satisfied. I do not think I must read it.

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* This is an error. I took the question to be, "There are some firms who conduct their trade entirely in bottled milk." I know of no *towns* in which the trade is entirely conducted in this way.

Mr. J. Long.

17 Jan. 1900.

4610. Very good, I do not press for it?—It would show exactly to whom it applies; I do not think it should go into the printed evidence.

4611. Then all that your evidence on this point amounts to is that facts have come to your knowledge which satisfy you that milk is liable to be repeatedly treated with preservatives, as it passes through different hands?—Yes, that is so, but of course that is not sufficient for my purpose. The statement was very urgently and pertinently contradicted at the London Dairy Show by prominent London men, and therefore I was most anxious not only to repeat it but to prove it; but it is difficult to prove unless, as you say, you print the letter of another man. I was going to say that for twelve years I have sent milk to London myself from Romsey, in Hampshire, eighty miles, and from where I live in Hertfordshire it is about seventeen miles, partly from one place and partly from the other, part of the time, and that on only two occasions has it been returned to me or have I been notified that it has been off and slightly advanced. I think I may say that on each occasion I could account for it—imperfect cooling.

4612. The line from Romsey is one peculiarly exposed to the sun, is it not—it is the South Western?—Yes, it is. It is a branch line from Eastleigh.

4613. (*Professor Thorpe.*) What is the length of time of the journey?—About two hours and three-quarters. Each winter from October to March the mornings' and evenings' milks have been mixed together. I should like to point out to the Committee that Professor Johnson, of the Massachusetts Station, points out in the *Journal of the American Chemical Society* that he has shown that salicylic acid arrests peptic digestion. That, of course, is only second-hand evidence. The next thing I should like to say is with regard to the influence of drugged milk upon invalids. I have a daughter, and I think that is very good evidence, who has been suffering from tubercle of the lung, she has had to consume daily two quarts of milk. It was given in evidence here by one gentleman that he had found 210 grains of boracic acid in milk—that is at the rate of 105 grains per two quarts. All I can say is, that I feel confident that it would be very hurtful to such a patient as my own daughter to consume 105 grains, or a quarter of that, daily for twelve months together.

4614. (*Chairman.*) Have you got anything to tell us in relation to the difference between the Irish and Danish systems?—I have not got to cream or butter yet—unless I am exceeding the time you wish me to occupy?

4615. Take it in your own order?—Thank you, I should like to do so. I have another case to show, the influence of milk that has been fortified with preservatives. A young lady, a Miss Stewart, whom I know, drank some milk at one of the railway stations, a glass of milk, which she knows, as a dairy expert, was preserved. She was violently ill afterwards, and was afraid she would die; she had to be taken in hand by some people as she was going home, and helped with some brandy. Another young lady, who is the chief of a dairy school, has also a similar experience, and she has proved the deleterious character of milk that is preserved and sold at railway stations.

4616. She has proved it?—Yes, she has proved it—I mean by its effect upon her own system.

4617. She has experienced the results?—Yes, I used the word "experience."

4618. To say that you prove a thing rather requires proof, does it not?—It does, I suppose, in one way—to scientifically prove it.

4619. All that comes to is that these persons attribute certain symptoms to having consumed milk containing preservatives?—Yes.

4620. But there is no proof connecting the two. I submit, Professor Long, that this is evidence rather of a medical nature. I understand you come here representing the Chamber of Agriculture; we want to hear their views; we have had an immense deal of evidence of a general nature, and we look to you to give us something specific—of which you have already given us a good deal—and as time is valuable——?—You will excuse me, I am sure. There are large numbers of people who feel as strongly as I do, and who believe they have evidence of this character to give, and who have no vent at all. I have a similar case in my own experience. It is all very well for medical gentlemen to come here with their particular experience, but we ought to have some means of giving our experience as well.

4621. We exercise our discretion with regard to the evidence we invite?—I quite understand that.

4622. We invited you here as representing the Chamber of Agriculture, and we do not wish to have general impressions, which are valueless to us; we do not want to waste our time over them?—I am sure I do not know what I am to say then. I am afraid most of the evidence I can give will not be evidence that anyone can prove.

4623. You have given us a good deal already which is the result of your own experience. I accept that. I do not want to stop you if you think it is necessary. I only want to save you trouble?—I know I was nearly killed myself by eating high meat. Of course, there again the fact comes in that I do not know that it was preserved.

4624. (*Dr. Tunnicliffe.*) I think you did not finish your sentence—you were nearly killed by eating high meat, but you do not know that it was preserved?—I do not know that it was. I can simply say that I suspect it was.

4625. (*Chairman.*) Professor Long, you know the nature of evidence. I ask you if you think it is worth putting that on the notes?—That is not for me to say.

4626. I ask you to consider how it reflects upon the rest of what you state in evidence if you consider that ought to go on the notes?—I quite see the point.

4627. It is in your own interest. On the whole, I take it, you feel a strong objection to the use of what may be called hurtful drugs in articles of food which, owing to their nature, are consumed without warning to the consumer?—Yes, I do. I object very strongly to be drugged without knowing it.

4628. I think the impression you wish to convey to the Committee is that you suspect that a good deal of injury is done to consumers from the general and increasing use of these preservatives?—Yes. May I pass on to butter? I can give you some evidence of another character.

4629. If you please. I may tell you we have had a great deal of evidence both of Irish and of Danish butter. I do not know that you have any new facts to bring forward?—The first remark I should like to make is that evidence has been given here by Mr. Bannister in which he says that Danish butter cannot compare with Normandy butter. I take notice of this because Danish butter is not preserved, and a great deal of the Normandy butter is. The fact is that during the past three weeks in the Paris market, the price of Danish butter has been Frs.3.60c. to Frs.4; Normandy butter, Frs.3 to Frs.3.30c.; and the best French of any other kind, Frs.3 to Frs.3.72c.

4630. Is that Frs.3 the kilo?—Yes, it is. That was *en mottes*, the only manner in which you can compare the butter which goes into the Halles. This I take from *La Laiterie* of last week.

4631. That shows that the Danish butter commanded the highest price?—Yes.

4632. Was that butter absolutely fresh, or slightly saline?—It is quite fresh butter. I have got the figures in England for three months, which I have taken from the published returns. Danish butter topped the market. In September it was 127s. to 130s. 6d., French being 108s. 6d. to 123s. In October the Danish was 124s. to 128s., and the French 110s. 6d. to 120s. In November the Danish was 116s. 6d. and 115s. 6d., and French 110s. to 116s.

4633. Is that also fresh butter?—That is the same—the best brands of Danish and the best of the Normandy butter.

4634. Are you perfectly certain that that Danish butter contained no salt?—No, I do not say that. Fresh butter can contain salt. It is a fresh butter with a quarter of an ounce to the pound—that is, for flavouring purposes.

4635. I asked you particularly if it was absolutely fresh; but with one per cent. of salt is not absolutely fresh?—No, not with one per cent.

4636. What percentage of salt had the butter which you have been quoting?—I do not know, but I should say less than a quarter of an ounce per pound.

4637. But you do not know?—I do not know.

4638. (*Dr. Tunnicliffe.*) Where were the English figures taken from?—They were taken from the "Journal" of the Board of Agriculture.

4639. (*Chairman.*) There are several grades of French butter?—Yes, many; but the first brand is the Isigny brand.

Mr. J. Long.

17 Jan. 1900.

4640. Is that Normandy butter?—That is in the county of Manche.

4641. That is in Brittany, is it not?—I do not think it is in Normandy; I think it is in Brittany. But the term we apply in England to "Normandy butter" covers a great deal more ground than it does in France.

4642. It means that it comes from a Normandy factory, does it not?—Most of the French butter sold in England comes from the factory of Bretel at Valognes. I should like to add, if I may add to that, that until the French introduced this almost tasteless and saltless butter English butter which was slightly salted was always called "fresh," and in some parts of the country is still called "fresh," being salted to suit the consumer. As an example of butter keeping without salt or without preservatives, I bought the champion butter at the Dairy Show, produced by Lord Rosebery's dairy woman in 1898, and in 1899 produced by Mr. Underwood, a farmer, I think, in Buckinghamshire. The 1898 butter kept for a month —I cannot say how much longer, but I believe longer— and the 1899 butter kept for six weeks. The butters were almost perfect at the end of those times.

4643. Have you any observations to make on the Irish butter trade? We have had it from Irish witnesses that if preservatives were prohibited, the Irish butter trade would be thrown back to where it was some years ago?—I have had a good deal of experience amongst Irish factories, and I could tell you anything pretty nearly that you want to know about them.

4644. Is there anything in the quality of the Irish butter arising from the pasture or the mode of manufacture which renders it inferior in keeping quality to the best Danish butters?—I believe not. The Irish system has been undergoing a considerable change during the past seven years. About seven years ago there was a great trial at Manchester, and the Manchester Corporation put into my hands the arrangements for the witnesses. Then the Irish people came over with very strong evidence in favour of their system of pickling the butter. They told the Bench that it was impossible to produce this butter unless they pickled it, in consequence of the presence of the large percentage of water in Irish butter. Within the last two months analyses have been made by Mr. Thorpe, of Limerick, of a number of samples of Irish butter, taken from the different creameries. The average per cent. of water in those samples was twelve and a half, or precisely the figure given by Duclaux in France, and by Fleischmann in Germany, as an example of what good butter should be.

4645. Was that a factory butter?—That was an Irish factory butter.

4646. It was not a creamery butter?—The Irish is all creamery butter.

4647. I thought you told me it was factory butter?—That is the same thing—I do not discriminate between one and the other.

4648. I beg your pardon, they are quite different things. Do you draw no distinction between a creamery and a factory?—At one time I called them all factories, and they were all called factories where butter was made from milk handed in by the farmers. Then the creamery system, as it is now known, was dubbed "the creamery" by, I believe, the Canadians. The blended butter has been sometimes called factory butter since then; so you may have in your mind the factory as being the blending house and the creamery as being the co-operative butter-producing building—that is the only difference.

4649. On what do you found that statement?—Experience.

4650. Then why is it contrary to the statement of those who are engaged in creameries and factories?—In what way, may I ask?

4651. It has been distinctly explained to us by more than one witness, that the difference between a creamery and a factory is this—that whereas the creamery takes in the milk and mixes the butter on the premises, the factory receives the butter and manipulates it, works it into a uniform article for the market?—That is just what I mean. That term creamery has been introduced within the past few years.

4652. What do you call the last few years—it has been in existence now for twenty years?—I mean certainly within the last six years.

4653. Introduced where, within that time?—Into this country, the name creamery. Originally they were all called butter factories.

4654. I beg your pardon, it is within my own knowledge that that is not correct. Did you ever hear of the Dunragit Creamery?—I have been there.

4655. Are you not aware that there has been a Dunragit Creamery for more than twenty years?—I call it a margarine factory myself.

4656. Do you not know that it has been called the Dunragit Creamery for twenty years?—I do not know that of my own knowledge.

4657. You can take it from me I think?—I only know that ever since creameries and factories have been in existence I have been a visitor to them, and one of the oldest visitors, and have known the names by which they have been called, but still that is quite immaterial.

4658. You think it is a question of manufacture and not of quality?—I think that when the Irish people have entirely adopted the Danish system—and they have commenced to do so—they will be able to do as the Danish people do, and not until then. With regard to the statements which have been made that it is the public who demand this preserved butter, I should like to say that, on the contrary, it is the trade that has provided this particular butter—I will not say compelled, but morally compelled the public to buy it. At the Skeldale Dairy in Yorkshire no preservative is used, and they find that where there is any uncleanliness in the work it is necessary in making butter to use preservatives. The next remark I have to make is with regard to pig meat. It has been stated that the consumers will not revert to the salt meat of twenty years ago, and it is harassing the trade to prevent them using preservatives. I know as a matter of fact, if I may use the word advisedly this time, that with one exception in Ireland no bacon curing factory uses a preservative, and if there is any meat in the world that is mild cured it is the Irish bacon, which realises perhaps the highest place in the trade.

4659. It has been maintained before us that Ireland is nearer the large markets of this country, and that the Transatlantic supplies would be transferred and limited by imposing restrictions on the use of boracic compounds —boracic packing; is that so?—I believe that is quite true.

4660. You would not be able to bring any mild cured goods with the same facility without the use of preservatives?—Not without cold chambers; and as the Canadian Government provide very great facilities for the introduction of butter into England, I do not see where the difficulty arises why they should not do the same thing with regard to the meat.

4661. Do you object to boracic packing?—Personally I object to boracic acid in any way in connection with food.

4662. It is maintained that it does not enter into food when it is merely used as a dry packing?—It is largely used, and I quite admit that that is what is contended.

4663. But you are not satisfied that it is so?—When you know that there are some sixteen or twenty foods on the market, all of which are preserved with the same preservatives, then I think it is time that something should be done to prevent the excess at all events as regards the meat. But my objection is to the evidence that there was practically no mild cured bacon and hams excepting that which was cured by the aid of this boracic acid. Then the question also arose with regard to the fruit. I should like to relate the fact that by the aid of the same sterilising apparatus I have been able to preserve fruit without anything at all in addition excepting water with great ease and perfection. If you get the right bottles there is no difficulty in producing the fruit as perfectly as possibly through the winter.

4664. I suppose they go off colour a bit, do they not?—Yes, they do.

4665. (*Professor Thorpe.*) Does the preservative arrest the change of colour?—I have no experience of that. Then with regard to the Danish system the milk from the Danish farms is delivered by people whose premises are regularly examined.

4666. (*Chairman.*) Delivered where?—In Denmark. Their premises are examined by the inspectors attached to the different factories.

4667. But, pardon me, you speak as if the system was exceedingly uniform; we all know it to be very much so; but it is not quite uniform, is it?—I was just at that very moment going to say that there are exceptions, as there are in England and elsewhere. That the organisation is very perfect, I know. I have been going to

Mr. J. Long.

17 Jan. 1900.

Denmark and back since 1883, and I have had great opportunities of seeing what they do. To pass from that the point I want to show is this—although you no doubt know it as well as I do myself—that the milk having been pasteurised is practically sterilised, at all events for their purpose. It is then inoculated with fresh germs by means of which the flavour is maintained as well as the keeping quality. Until something of the same kind is done in Ireland and elsewhere we cannot expect the butter to keep so well.

4668. You do not think that there is any loss of flavour consequent upon pasteurising the milk?—No, I do not; but I think that the flavour is not so fine as it is in our own English prime butter.

4669. Do you think that by the introduction of certain bacteria you can improve that flavour?—I think you cannot make it anything like so well as we can make our own under the old-fashioned English system, under clean conditions; I know you cannot, because at the London Dairy Show no butter has a chance against our own prime make.

4670. (*Professor Thorpe.*) This system in Denmark is largely due to the circumstance that tuberculosis exists very widely there, is it not?—No, I do not think so at all.

4671. We have been informed that the reason why pasteurisation has made such headway in Denmark is with the view to stamp out tuberculosis?—I think that has been enhanced in consequence of the prevalence of tuberculosis; but from the very first inception of the Danish system—I do not remember the inception, but I know all about it since 1883—they have been progressing and experimenting with a view of producing a fine flavoured and a keeping butter without any regard to the tuberculosis question at all. I do not say it has not entered into it; of course, it has pushed them on a bit. I should like to add to what I have said that the adoption of preservatives paralyses any advance in scientific work, and that cleanliness is the essence of the industry. Dirty habits from the cow upwards can be covered by preservatives. The object of investigation in dairy work is how to keep germ life, and especially the unfriendly germ, within bounds, how to prevent their rapid multiplication, how to keep the cattle, the hands of the milkers, the atmosphere and the vessels pure, how to secure pure cream minus unfriendly germs, and how to make butter keep long enough for all practical purposes. Fine butter is impossible when preserved. Perhaps I should qualify that statement; the butter that comes on to the London market from France, to take France as an example, is an almost insipid and tasteless article, and if compared with fine samples of home-made butter it is simply nowhere.

4672. It commands a higher price in this country?—The French?

4673. Yes?—But if you are making fine butter from a Jersey or a Guernsey herd, or a mixed herd of good cattle, one is even now able to obtain 16d. to 18d. a pound.

4674. My question was: Does not the French butter command the higher price?—It sometimes reaches 16d.; I do not think higher.

4675. The average price paid for French butter in this country is higher than the average price paid for English butter?—I quite admit that.

4676. But not so high as the average price paid for Danish butter?—No.

4677. (*Chairman.*) So Professor Long says, and I am surprised to hear it?—That, with the slight exception of the Isigny brand, is in consequence of the fact that the French butter that comes to England is the cream of the Norman butter-making district, and is therefore and must be all good to sell; whereas in England we are not a butter-making people, we have no great market for our own butter, and the only brands, if I may so term them, of butter that are sold at good prices are the brands of private makers who have private customers. The large quantities of butters as in Cumberland and Lincolnshire, which realise very small sums, really have no market of their own. If I make butter from milk in a dirty dairy it is certain to be bad in from three to four days, and if I add preservative to it it will still remain sweet at the end of a week. That is a fact that I know from my experience, and I would advance it in proof of the statement that the employment of preservatives is a premium on bad dairying. A cow which is never groomed, whose coat is kept dry, will, when milked, help the atmosphere to drop into the pail of milk, handled by the milker, 100,000 germs in a minute. These figures are taken from the experiment of Dr. Russell, who made it some time ago, and who made very many deductions from it. That milk will soon spoil; preserve it with boracic acid and it will keep. Keep the cow clean, her coat moist, and sluice the cowhouse well down with water twice daily, scald the pails, and the milk will keep without any preservative whatever. I have made a note on the paper of an example cowhouse. The example cowhouse should be an open building.

4678. I think this is going rather beyond our field; it is sufficient for us to get from you an expression of your conviction that the use of preservatives is not necessary to the dairy trade?—That is my opinion.

4679. You see we should be travelling rather beyond our reference if we went into the model dairies and cow houses?—Just as you like; it was simply put on my paper as sent in, and therefore I referred to it.

4680. Is there anything else?—I do not know what to say; I should have been glad if the items had been struck off the paper that I received. I wanted to show under what conditions milk can be kept without any preservatives, and how it is impossible to keep it if you produced it under bad conditions.

4681. Very well?—But I do not want to bore the Committee for a moment. Shall I pass to the next point.

4682. I must leave it to your discretion, of course. I do not know what you are going to tell us, but I think we are not prepared to go into the model cow houses?—I must leave myself in your hands; I have no more to say then.

4683. You have no more to say?—I have plenty more, but I would rather not give the evidence.

4684. I see you have something down about colouring matters; are you prepared to tell us anything about them?—Colour is used in two or three makes of cheese only, but it is not used, or barely used, to any extent in England in the manufacture of Cheddar cheese, which is our most important brand by far, and it is not used in Stilton. It is used in butter, but a butter maker can maintain the colour of butter by the addition of a Jersey or a Guernsey cow to every ten or twelve cows, and also by the selection of cows of the shorthorn breed. Many shorthorns will give systematically a rich-coloured butter in winter, unless you feed very heavily upon mangolds, and many shorthorns will not. My suggestion is that by the selection of good shorthorns, or by adding a Jersey or a Guernsey cow to the herd, it is possible to retain the colour at all seasons, and under all conditions. I believe annatto to be a harmless material when added to food, but there are other materials which are deleterious, to which I should like to refer, although they are not any evidence of my own. This is from the experimental work of Mr. Cochrane from the Pennsylvania Station, who studied six commercial butter colours, three of which were the products of coal tar, five solutions in oil, and one in the form of a powder. These colours are called aniline yellow, and methyl orange. Doses of 24 to 32 drops produced headache, loss of appetite, nausea, vomiting, and nervous depression, the intensity of the symptoms varying with the amounts taken. I have no knowledge myself of these materials, but there are so many in the market that I think attention should be called to the fact.

4685. You support the view of the Chamber that the use of colouring matters should be prohibited in dairy produce?—Yes, I do.

4686. Would it interfere seriously with certain branches of the trade; people have prejudices or tastes in favour of high-coloured cheeses, such as North Wilts or double Gloucester?—It possibly would for a time; I do not think people when they were told that it made no change in the flavour or in the quality would be so unreasonable as to retain their idiosyncrasies for any length of time.

4687. Would there be anything in a North Wilts cheese to cause it to be preferred to another, but for the colour?—Nothing at all. They are precisely the same. You make one without, and one with the colour, but otherwise they are precisely the same cheese.

4688. But the fancy of the consumer has a good deal to do with it, I think?—Yes, it has no doubt to-day, but they will get used to the change.

4689. Then you have got a note on your précis about recommendations. I do not know whether those are general or whether they refer to particular points?—These recommendations are based upon an assumption that preservatives might be permitted or might not be tabooed by this Committee. Assuming

Mr. J. Long.

17 Jan. 1900.

that they are allowed I would suggest in the first place that where facts are unknown as to the influence of preservatives on children and invalids they should be prohibited. The second is that if it is decided to recommend the continued use or to permit the continued use of preservatives that use should be notified, and the word "preserved" used precisely as the word "sterilised" is used to-day. The third is that the seller should be restricted to one material, and to a limited quantity of that material. The fourth is that preservatives should be used only during the three hot months of the year.

4690. (*Dr. Tunnicliffe.*) You have quoted, I believe, from three or four opinions; would you kindly hand in the exact references to the periodicals in which those opinions appear?—I will, certainly.

4691. Would you tell me exactly when and how this substance which you have kindly handed in to the Committee occurs, and so forth (*referring to the specimen of milk slime*)?—The milk was passed through the Laval separator this morning, and not separated, but the whole of it was allowed to go back again into one vessel, it being simply put through for experimental purposes, the bowl being perfectly clean beforehand—indeed, it had not been used before for some months. When the milk had all been emptied from the bowl of the separator that scum was gathered from it—it was not the whole of it, of course.

4692. Was this at the bottom?—That was from the periphery—from the interior.

4693. Of the bowl?—Of the bowl; it is only a portion of it.

4694. (*Professor Thorpe.*) What do you imagine that mainly consists of?—I think it mainly consists of dirt, epithelial cells, and bacteria—possibly some portion of the solids of the milk.

4695. (*Dr. Tunnicliffe.*) What was your object in bringing this individual sample, so to speak, before the Committee?—It was to show that where milk is dirty it cannot be expected to keep so well as if it were clean, and that in many cases where a tradesman says "The milk that I receive from So-and-so will not keep so well as that received from somebody else does," it is owing to the fact that it is not so well cleaned, and therefore it requires a preservative. If they insisted upon conditions such as they do with regard to cooling they would get their milk to keep much better.

4696. I understand that you throw the entire responsibility of the statements you have made with regard to the action of preservatives on digestion and so forth upon the authorities from whom you quote?—Yes.

4697. (*Dr. Bulstrode.*) Do you consider there would be much difficulty in properly cleaning bottles, supposing sterilised milk were used?—Not at all.

4698. No more than in cleaning the ordinary cans and receptacles?—Yes, there is.

4699. Then there would be difficulty?—There is more difficulty than that, because when you are cleaning a can—you mean pails, I suppose?

4700. I mean the small milk can in which the milk is distributed from house to house?—They come back almost fresh, and are easily cleaned, but the bottle is kept for a week possibly, or a fortnight possibly, by the consumer, and it dries on the interior into a sort of casein—a hard albuminous matter—and it almost wants scraping off with a knife—I should say it almost would want that, unless you had some special means of cleaning it.

4701. Is that with a weekly service of the milk?—Yes.

4702. Of course, if there were a daily service that would not occur?—It would not occur at all.

4703. You have stated in your recommendations that if the effects with regard to the influence of preservatives upon children are unknown they should be prohibited?—Until something is known.

4704. Is that not rather a dangerous principle—that because you do not know what the exact effects are, therefore you are to assume they will be harmful?—I do not know, I am sure.

4705. What would be your evidence that they are harmful—upon what would you base that presumption?—If you ask me to take a drug of which I know nothing—quite apart from this particular inquiry—I should say, Do not give it to me until you know what it is; if you cannot tell me what it is I will not take it.

4706. You think you ought to know what it is?—I think I ought to know.

4707. (*Professor Thorpe.*) The only question I wish to ask you is, Will you kindly say to what extent your system of pasteurising milk increases the price?—It is retailed at $4\frac{1}{2}$d. a quart—that is, $\frac{1}{2}$d. more.

4708. The cost of the pasteurisation of a quart of milk is $\frac{1}{2}$d.?—I put it so, with the breakage of bottles and so on, but it is retailed in London now at 4d.—at precisely the same price as ordinary milk.

4709. Supposing that the operation became general, would it very considerably increase the price? I suppose that it is because that, on a relatively small scale, you put it at $\frac{1}{2}$d.; but supposing it were made nearly universal, would it greatly enhance the price of the milk to the consumer?—No, I think it may be sold then at 4d., as it is now. I know firms who sell it very largely at 4d.

Mr. WALTER WILLIAM FISHER, called; and Examined.

Mr. W. W. Fisher.

4710. (*Chairman.*) You are, I think, Aldrichian Demonstrator of Chemistry in the University of Oxford?—Yes.

4711. You are also public analyst for the counties of Oxford, Berks, and Bucks, the city of Oxford, and the borough of Banbury?—Yes.

4712. And you are President of the Society of Public Analysts?—Yes.

4713. I think you have been public analyst for Oxfordshire for some considerable time?—For eighteen years, and for the other places for nearly as long.

4714. You have generally informed yourself, I think, on the subjects which have been remitted to this Committee for investigation?—Yes.

4715. Are you prepared to make any general statement to the Committee on the views of the body of gentlemen whom you represnt? In the first place, may I ask if you represent the Society of Public Analysts officially here?—Yes. They were invited by the Committee to send representatives, and they asked Dr. Stevenson (my colleague) and myself to represent them; but I have no authority from the Society to represent the views of the Society as a whole, because the Society has not come to any definite conclusions on some of the important matters which will come before this Committee.

4716. Then what you have to tell us simply is given on your individual responsibility?—Partly so, and also partly I have drawn up a statement for the Committee of the facts as to the actual use of preservatives, which we have been able to gather from our members. (*See Appendix No. 12.*)

4717. Could you briefly summarise those facts?—There are a great many articles upon which it is almost impossible to get any information, because such articles are not commonly purchased for analysis by the inspectors under the Acts, but I have been able to collect some information with regard to some of those things in various ways, partly by getting some samples collected for myself, and also partly by asking my colleagues to help me. With regard to the fresh meats, if you would take the arrangement I have adopted, I can say that the use of boracic acid or preservatives is not very common, but boracic acid is sometimes used to preserve fresh sausages. It is much more commonly used in salt meats, and such things as German sausages, and also bacon and ham. I have given in my synopsis a good deal of detail as regards figures; I do not know that I need trouble the Committee with all these figures, as they have my statement before them. The proportion of boracic acid in German sausage appears to be something like less than a half per cent., reckoned as boracic acid. The proportion in bacon and ham appears to be from one-half to three-quarters per cent., and some samples have been found to contain rather less. Meat extracts appear to be generally free from preservatives as far as my information goes. Some kinds of potted meat contain a good deal of salt as a preservative agent, but nothing in the shape of boracic acid. I have put in a table in my statement, which Mr. Richmond was good enough to send me, of the composition of some of the mixtures of borax and boracic acid which he has examined, and of which he has determined the percentage. I do not know that there is any other important matter which I need mention in connection with meats or fish. In relation to dairy pro-

Mr. W. W. Fisher.

17 Jan. 1900.

ducts, the use of preservatives in milk and dairy products is, of course, as the Committee knows, very common, but the extent to which the practice is adopted seems to be different in different parts of the country. Dr. Bernard Dyer has sent me some valuable information upon this point. He found that only one sample out of 270 milks contained boracic acid at all, but out of 234 samples of butter 30 contained boracic acid, the average quantity being under a half per cent. There were only two which contained more than 1 per cent.—1·06 and 1·35.

4718. Where were those samples taken?—Those butters were country samples. Dr. Dyer, the analyst for Leicester, Wilts, and Rutland.

4719. Country samples bought for sale in a town?—Bought by the inspectors under the County Councils of those districts.

4720. (*Professor Thorpe.*) The origin of these butters would not necessarily be known?—It is usually unknown.

4721. They might be foreign butters?—Yes; we have no information about them at all; we simply know that they are purchased from John Jones on such and such a date by the inspector. That is all the information.

4722. The statements of course from individual analysts in your synopsis are exactly on a par with what we have had from some of them who have appeared before us; they are exactly of the same character?—Yes, some of them have come before you.

4723. For example, Dr. Alfred Hill was examined here at considerable length, and gave us substantially the information which is contained in your synopsis?—Yes, I understand so.

4724. Would it not save time perhaps if this synopsis were summarised, and you handed it in as evidence gained through your Society of the prevalence of those things?—It no doubt would do so. I conceived it was rather my duty to set it forth at length, and to show the authority for the various statements; but of course it is quite in your hands to condense it as much as you please.

4725. If you therefore handed in the paper and it was placed as an appendix to our report as expressing the experience of the general body of members of your Association it would suffice?—Yes, that would suffice. This is nearly all the information I have been able to gather from individual members. Some of our members did not forward any information at all.

4726. That is as regards the use of preservatives. Now, have you anything yourself to tell us, any opinions which you have arrived at as to what should be done with regard to the use of preservatives?—I think that it is desirable that the free use of these should not be legalised, and that some effort should be made to limit their use, because the use of the preservatives has no doubt grown very considerably, and unless it is checked in some way it will still further extend, and then it will become very difficult, if not impossible, for persons to get articles of food free from preservatives unless some means is devised for enabling them to choose whether they will take them or whether they will not.

4727. In other words, you recommend that the fact of the preservative should be declared?—It should be declared in some cases, but I think it should be prohibited in some other cases.

4728. Would you kindly indicate where it may be declared, and where it should be prohibited?—My desire would be entirely to prohibit preservatives in new milk. If it is sold as new milk it should mean new milk and nothing else, nothing whatever being allowed to be added to it. I do not ask the Committee to legalise the use of milk containing boracic acid, but if they think it is their duty to do so, then I would suggest to them that they should fix a superior limit for the quantity of boracic acid which is present, and that they should say that the presence of this boracic acid should be declared in some way or other—either that the milk should be called "preserved milk," or that the name "boracic acid" should be put upon the milk which is so treated. It seems to me that is the only method by which you can ensure getting pure milk for the use of invalids and infants, to whom it is very important.

4729. Does this recommendation extend also to the use of formalin?—I do not dogmatise about formalin. I am rather suspicious about formalin myself for this reason, that I have noticed when milks are preserved with formalin it is very difficult to dissolve the curd in hydrochloric acid. In the ordinary process oft estimating the fat by the Werner-Schmid method you have to dissolve the curd in hydrochloric acid, and the presence of formalin makes it difficult to dissolve the curd even in hydrochloric acid of a considerable degree of strength. But I do not dogmatise on the subject of formalin as I cannot say of my own knowledge what the effect of very small doses of formalin would be on the organism.

4730. Do you infer from the behaviour of the casein in the Werner-Schmidt process, that the presence of formalin in solution in milk would be harmful to the gastric fluid?—That is what I should be suspicious about.

4731. That is your opinion?—That is what I should be suspicious about. I know of course that there are a certain number of experiments by Dr. Rideal, which rather militate against that inference, but they do not dispose of it to my mind altogether.

4732. Now, assuming that it is found necessary to legalise the use of these preservatives, and it was considered expedient that the nature of them should be declared, I understand that you would further recommend that some limit should be imposed as to the amount in which they may be used?—I think that would be desirable. The facts which I have placed before the Committee show that there is a great variation in practice as to the quantity of preservatives added to milk. The people who sell these preservatives very often put upon the package a statement that the preservative is absolutely harmless, and the milkman who uses it has no special knowledge as to whether it is really so or not. I think it is desirable therefore to fix a superior limit.

4733. Would you not see, speaking in your capacity as President of the Society of Public Analysts, some difficulties in carrying out in practice such a recommendation, that is to say, as to checking the limit of the use of such things as formaldehyde and boracic acid on account of the difficulties of the quantitative determination of those substances?—Yes. It is not so easy to get at the exact amount of either, and you could not squabble about the exact decimals as to the quantity of boracic acid.

4734. May I point out that any limit that would have to be fixed would come to a very small decimal place?—Yes, and then if you found a substantial amount such as one per cent., and the limit were 0·05 per cent., there would not be much dispute as to that; it is only where the quantity was slightly in excess of the small limit, which might be authorised that the dispute would arise.

4735. You are speaking from your knowledge of the working of the Act, and the occasional great difficulty there is in bringing legal proof in matters of this kind to the mind of the bench?—Yes.

4736. Do you not think there would be, say, in the case of formaldehyde the greatest possible difficulty when all the facts relating to formaldehyde were before the bench?—Yes, I think there would be a very great difficulty. They get tremendously confused over a question of a mere percentage sometimes. But it stands in this way now—somebody has to make a limit. Not long ago I reported that a sample of milk contained over one hundred grains per gallon of boracic acid. I pointed out to the authority for the County of Bucks that it was useless to take proceedings in such a case as that, unless they could get medical evidence that such a quantity was likely to be injurious to health. The medical officer for the district was of opinion that such a quantity was likely to be injurious to health, and he went into the witness box, and gave his opinion, and the seller was convicted. But that was in the absence of any expert evidence on the other side. If there had been expert evidence on the other side then you might have had a contest as to whether this particular quantity of boracic acid was or was not likely to be injurious to health.

4737. Very probably?—But, on the other hand, if there were a limit fixed—if this committee stated that they considered that milk ought not to contain more than a certain percentage of boric acid, we should have that opinion to appeal to, and we should be able to say that this committee, after a very full and careful investigation, had formed that opinion. That is how it presents itself to our mind.

4738. The case of boracic acid perhaps although presenting difficulties, does not present insuperable ones, but the case of formaldehyde is a somewhat more difficult problem, is it not?—I fully concur, and for that reason I do not dogmatise on the subject of formaldehyde; I rather avoid giving any opinion as to what should be done.

4739. If this committee had to make recommendations it would have to take the subject of formaldehyde equally into consideration?—It would.

4740. And if they made a recommendation as to the limits in respect of boracic acid, unless they had had absolute proof that formaldehyde ought to be prohibited, they would equally have to make a recommendation as to the limits in respect of formaldehyde?—Yes. Undoubtedly.

4741. Now, in view of the fact which no one knows better than yourself, how difficult would be the determination of formaldehyde—does not any suggestion as to a limiting value carry with it very great difficulties?—For formaldehyde it must; for boracic acid the difficulties are not so great.

4742. That is allowed?—Yes.

4743. (*Chairman.*) Would that difficulty not be in itself a reasonable ground for prohibiting the use of formaldehyde altogether?—It seems to me it would be a reasonable ground, especialy if the Committee can get sufficiently substantial evidence of the undesirability of putting formaldehyde into food. One suggestion I should like to make in that respect is this—invalids are often directed to use peptonised milk; and it would be possible to ascertain how far the peptonisation of milk is interfered with by the presence of formaldehyde. The method adopted is that the peptonising powder is put into the milk, which is left at a certain temperature for only a few minutes, and then the milk is assumed to be fit for use by the invalid. If the peptonising process is stopped for that time, or materially impeded, that is a reason against allowing formalin in milk. I throw that out as a suggestion to the Committee upon which they might get information from other sources. I have no direct knowledge as to the effect.

4744. (*Professor Thorpe.*) You have no recommendations then from your society as to the prohibition or declaration of the use of preservatives?—We have not passed any resolutions on the subject. The opinions which I give you to-day must only be taken as my own individual opinions, and not as a collective opinion expressed by the society. You would find that some members of the society—Dr. Hill, as you know—on very strong grounds indeed, would oppose the use of antiseptics altogether in certain cases. I do not know whether he goes so far as to prohibit them entirely.

4745. Have you anything more to add on the general question of preservatives?—I consider that new cream should be treated like new milk. I think that in the case of fresh meats and fresh fish, if sold as fresh meats and fresh fish, no preservative should be allowed, and I would suggest that to the Committee. With regard to salted and preserved meats and fish, if a limit is fixed it should be a small one. I do not know that I am justified in saying that preservatives should not be allowed altogether in such articles as ham and bacon. There is one other class of preservatives that I have thought about, and that is the sulphites. I sent in to your secretary some figures as to the quantity of sulphurous acid which I myself have recently found—it is very small.

4746. In what articles of food?—I have found sulphurous acid in British wines, in vinegars, and in pickles in small quantities, and I have found it in one sample of anchovy paste—at least, I believe I did—and recently from one or two sources I have had mushroom catsup that contained a trace of sulphite. The quantity was very small, and, as you know from the statement which I sent in, it is used by some firms systematically in certain proportions. Considering the fact that sulphurous acid has a very easily recognised odour, and that the goods to which it is added must be kept until that odour has disappeared; I think the risk from the use of sulphurous acid must be very minute if there is any risk at all; it is so easily converted into sulphates, as you know, that I do not see any reason for prohibiting the use of this acid. In that connection I may mention one fact that has come under my own observation—that a firm which some years ago employed salicylic acid in its British wine now employs sulphurous acid in similar preparations. They were prosecuted for the use of salicylic acid. They brought down some eminent gentlemen to defend them, and they had expert opinion that the quantity of salicylic acid which was present in the wine was not injurious to health, and so on, and there was no conviction; but recently I happened to have a sample of British wine sent me officially from the same manufacturers, and there was no salicylic acid in that, but only a trace of sulphite; so I conceive that they have not found it expedient to give up the one and use the other.

Mr. W. W. Fisher.

17 Jan. 1900.

4747. Have you any views of your own to offer as to the use of salicylic acid as an antiseptic or preservative agent?—I do not feel that I know enough about the physiological action of salicylic acid to offer any distinct opinion, and so I think on that matter it would be rather better for you to ask my colleague, Dr. Stevenson.

4748. Have you anything more to say about the preservatives?—I have nothing more to offer.

4749. (*Dr. Bulstrode.*) Your experiments would rather tend to show as regards the examination of milks for preservatives that they were not necessary, at any rate in rural districts; would not that be so according to your figures?—That is my opinion, that it is not necessary in rural districts.

4750. And they would not be necessary in a place like Oxford—might we take that?—It would not be at all necessary either in the city or the county of Oxford.

4751. Some other figures which you have supplied seem to point in the same direction as regards rural districts, at any rate?—They do without it, as a rule.

4752. You think it would be impracticable to place a workable limit as regards the amount of formic aldehyde?—I am afraid it is at present, but the resources of science are never exhausted.

4753. At present, supposing we have to make a recommendation upon the evidence which has been put before us, and the evidence we are able to obtain?—As far as I know you could not determine accurately the quantity of formalin that is added to that milk, especially if it has been there for some time.

4754. As regards the action of formic aldehyde, do you know Dr. Foulerton's works?—I have read the paper written by Dr. Foulerton and Dr. Rideal.

4755. Dr. Foulerton found that when he put fish in water containing one in 40,000 of formic aldehyde, they lived indefinitely?—Live fish?

4756. Yes, live fish; but that when by an accident the amount of formic aldehyde became double they died within five hours. If it is very difficult to detect small quantities such as one in 45,000, and one in 50,000 of formic aldehyde, would not that rather point to the fact that in dealing with formic aldehyde we are dealing with a somewhat dangerous material?—I do not quite see that the difficulty of detection shows that it is dangerous.

4757. If in the proportion of one in 20,000 formic aldehyde is relatively rapidly fatal to fish, and it is difficult——?—I understand what you mean perfectly. I quite agree with that view. If you are using a substance which in certain doses becomes a poison that is a dangerous substance to put into food. For instance, corrosive sublimate could be put in certain proportions into a material, but it is so obviously a poisonous substance that it never could be used in food.

4758. You know that formic aldehyde has a very hardening effect upon the animal tissues when used in rather stronger proportions—about 1 in 5,000?—My biological friends do not like to dissect specimens that have been kept in formic aldehyde; they find the tissues so hard.

4759. So hard?—Yes.

4760. So that again would point to possibly a serious danger from the indiscriminate use of formic aldehyde?—It certainly points in that direction.

4761. The effect of labelling a specimen of milk, or what not, as preserved with formic aldehyde, would carry no guarantee to the consumer that there was not a harmful dose of formic aldehyde in it?—No, it would not, certainly.

4762. You have found, I think, as much as 100 grains per gallon of boric acid in milk?—Yes, that was the figure; it was over 100 grains per gallon. That was very high.

4763. We have had evidence before us that as much as 80 grains per pint has been found?—That is 640 grains in a gallon.

4764. So that apparently under the present circumstances it is being used rather indiscriminately?—It is used recklessly, I should say.

4765. (*Dr. Tunnicliffe.*) I should only like to ask you if you know at all what the quantity of formic aldehyde in the milk was, the curd of which was less soluble in hydrochloric acid than the curd of ordinary milk?—I am afraid I cannot tell you now. I am not even sure that I could reckon it. It is a thing I have noticed once or twice. What made me first notice it was that formaldehyde was

Mr. W. W. Fisher.

17 Jan. 1900.

put in the laboratory as a preservative for milk before it was analysed; the practice was to put in something like the third of a cubic centimetre in a six or eight ounce bottle of milk.

4766. And that was done in this case as far as you know?—About that. I could easily try it again. I have not tried it recently. Of course, that would be formalin, which is a 40 per cent. solution.

4767. If the presence of formic aldehyde were declared your objection with regard to the action of peptonising powders would not be so cogent a one?—No, it would not be so cogent; but I do not wish to recommend that formic aldehyde be legalised for milk at all; I do not wish to recommend that for a moment. I am so suspicious about it myself that I do not want to recommend that to the Committee.

4768. I take it that your view is that one wants to know very much more about formic aldehyde before we would be justified in recommending it?—Precisely.

4769. Have you any results to give to the Committee with regard to the presence of sulphites in beer?—No; I have not examined the beer for years. There is one statement by Dr. Rideal as to the quantity he found.

4770. I meant of your own?—I have none of my own; I have not examined any beer for years.

4771. (*Chairman.*) Now, can you tell us anything about colouring matters?—I have not much information upon colouring matters. In the North of England they mention congo red as being used to colour meat. I have not noticed it. There are cases where I have looked for it, and I have not found it. I have noticed that some meats —bloater pastes and similar things—are coloured with a little red ochre, not a very large proportion, but it is there, and sometimes the skin of a German sausage is dyed. The red colour of the meat appears to be most commonly due to the use of a little saltpetre, and I do not know that that is objectionable in a small amount so long as there is no quantity of nitrite formed. I believe the red colour —this is second-hand information—in meat which has been salted with saltpetre, as I heard from Dr. Haldane, is really due to a compound of nitrite with hæmoglobin. That is his view, I have not tried any experiments myself. Of course, nitrites are poisonous in anything like doses, but the small quantity used for meat has never been suspected of being poisonous so far as I am aware.

4772. (*Professor Thorpe.*) Are you aware that the preservatives which are introduced into meat are themselves coloured?—Some are.

4773. With what are they coloured?—One a mixture of borax and boric acid was coloured with Congo red; that was one statement from a colleague. Another of my colleagues said that the preservative was coloured with an aniline dye; of course that is a more vague statement as to what the colouring matter is.

4774. Then you may have a sausage coloured outwardly with an aniline dye and coloured inwardly with a preservative, itself coloured?—Yes, you may have such a sausage, but I have never met with one which was so rich in adornment as that.

4775. I have?—The colouring of the skin is not uncommon. I have not identified the colouring matters, but I have two samples out of five which I examined recently with a coloured skin; I put them in a spirit to soak and dissolved out some of the dye.

4776. Have you not been made aware of the fact that the ordinary sausage skin is occasionally coloured with Bismarck brown—that the imported skins are dyed with Bismarck brown?—I have not come across that. A sausage is a thing I have never examined professionally. Of course, it is the commonest thing to see in high-class shops a chicken and ham sausage or a veal and ham sausage with a bright red skin—that is the commonest thing.

4777. That is a brilliant red, and that is a dye?—Yes, it is a dye.

4778. I beg your pardon for interrupting you; will you proceed?—The list of substances which is given as being used here for colouring matters is, of course, very extensive; and the list for America is a bigger one than the list from any of my colleagues here. Dr. Leffmann in his statement mentions fluorescein, eosins, rhodamin, auramin, Naphthol Yellow S., Helvetia green, Acridin red, Bismarck brown, and safranin.

4779. These are, I suppose, mainly used for sweetmeats?—Those I should say are for confectionery mainly. In a stuff which was called lemonade, I think, or champagne-perry—one of those sweetened temperance drinks or aërated waters—I myself recognised a dye, and got hold of some of it from the manufacturer, who put it in, and found it was one of the azo-naphthol colours. It was a sulphonic compound.

4780. With respect to the colouring of the foods with mineral colouring matters, have you any testimony to offer to the Committee?—Chromate of lead I know has been used, but I have not come across it or heard of it recently; that is one mineral colour. I have found oxide of iron in a sample of burnt almonds, so called, which is a sweetmeat consisting of an almond for a kernel and a sugary envelope which is coloured slightly brown; I found a small quantity of oxide of iron in that which came to very nearly half per cent. I advised in that particular case that the seller of the sweetmeat should be told that was too large a proportion of mineral matter to put into sweetmeats, and that he was to communicate with the makers.

4781. With respect to copper in peas or other vegetables, have you had any experience?—Copper in peas is one of those things in which there is no limit either conventional or otherwise, and upon which you can get such a vast amount of conflicting testimony if you attempt to prosecute for them, that I have never advised my authorities to prosecute and they do not purchase them.

4782. (*Chairman.*) Conflicting testimony as to quantity?—No, not so much as to quantity; it is fairly easy to get an agreement as to the quantity of copper. The effects of the quantity of copper is the thing about which people dispute.

4783. (*Professor Thorpe.*) The object of the copper is, of course, to restore the colour of a faded pea, is it not?—No doubt it is to make them look green.

4784. To make them look green and more attractive?—Yes.

4785. (*Chairman.*) Or to prevent the pea from fading. Have you any experience yourself of that?—No, I cannot tell you as to the really chemical explanation of it. You mean there is a combination of the copper with the chlorophyll—possibly, but I cannot tell you.

4786. Do you yourself consider it an objectionable practice to add copper to peas?—Yes, I think it is. I think that if people buy preserved peas they can be educated to buy them as they come out from the processes of boiling with salt and sterilising and so on. They have a certain appearance which differs from that of fresh peas, and I think the addition of copper is objectionable.

4787. Do you put the ground of your objection on the possible danger to health or on the fact?—The reason I object is that I consider there is a danger to health when the quantity of copper reaches a certain amount, but that again is one of the points upon which one has only a second-hand opinion.

4788. But is it not the fact that the use of copper in peas allows of the substitution of a pea which, so to say, has gone off colour, and which competes with a pea which has been preserved by a somewhat better method, and which has retained its colour?—I think it is very probable that it does, but I do not know that as a fact.

4789. Surely a pea which has been dyed, when the dye is not too apparent, which successfully simulates a properly preserved green pea is in unfair competition with it?—I agree perfectly with that. I do not know that it is the fact, but I think it is very possible.

4790. Then you think that to dye a pea in that way is to some extent a fraud upon the purchaser?—Yes.

4791. You think so?—Certainly. If the purchaser is made to buy an inferior article by reason of its being dyed, it is to a certain extent a fraud.

4792. He is deceived, evidently he is led to believe that he is buying a fresh pea?—Yes, exactly. People are constantly misled in the country by the way in which articles are got up for the market.

4793. Have you anything else to tell us with respect to the prevalence of colouring matters in articles of food?—I have mentioned in my statement the cases of some jellies. The jellies which have become rather popular in recent years are sold in a half-dry condition, so that they are just as tough as jujubes. They contain gelatine and sugar with some flavouring, and they are very commonly coloured—some of them being highly coloured. I meant to have brought a piece of ribbon, but I forgot it at the last moment. I dyed some ribbons with some of the dyes from jellies, and I thought I would bring them before the Committee, but I forgot them.

4794. Are those injurious colours?—They are very small in quantity. In large quantities no doubt some of the colouring matters are irritating bodies; but I could not say in the quantities in which they are present in the jellies that they are injurious. Such colours are used for dyeing those jellies—yellows and reds particularly.

Mr. W. W. Fisher.

17 Jan. 1900.

4795. (*Dr. Bulstrode.*) Do you know anything as to the solubility of copper when used for colouring peas—I mean as to whether the colouring matter produced is soluble in the human system?—I have never tried any experiments. Of course, I know that copper forms with the proteid substances, comparatively insoluble bodies, but I do not know anything about the further solubility of these proteid compounds in re-agents. I have not tried any experiments upon that subject.

Dr. T. Stevenson.

Dr. THOMAS STEVENSON, called; and Examined.

4796. (*Chairman.*) You are a Doctor of Medicine, Fellow of the Royal College of Physicians, Lecturer on Chemistry and Lecturer on Forensic Medicine at Guy's Hospital, Scientific Analyst to the Home Office, President of the Institute of Chemistry, and Public Analyst for the counties of Surrey and Bedford and for the Metropolitan parishes of St. Pancras and St. Leonard, Shoreditch?—I am.

4797. (*Dr. Bulstrode*) I believe you have gone into the question of preservatives in food, and you have given us a synopsis with regard to your views upon the question?—Yes, I have.

4798. With regard to the examination of the milk which is supplied to Guy's Hospital, you say, I think, that you have found boracic acid in the milk—could you tell the Committee the amount which you have found?—No; it was small, and I only found it on one occasion. Within the last few years, I may say within the last half dozen years, the milk contracts are drawn up under my supervision, and the use of preservatives is absolutely prohibited. I have examined it from time to time, and on only one occasion have I found a small quantity of boracic acid.

4799. Do you say the use of preservatives is absolutely prohibited in the milk supplied to Guy's Hospital?—Yes.

4800. Could you give the Committee the reason which led to this resolution?—I was asked by the Governors to advise on the contracts, and acting on my own opinion I thought it was quite inadvisable and quite unnecessary that boracic acid should be used; my experience of the milk supply of London being that it may be brought from more than a hundred miles, say, from Derbyshire, and delivered in London and supplied to the public without the use of any preservative known to me.

4801. Do you think there would be no difficulty in carrying on the milk supply of London, even in the poorer parts, without the use of preservatives?—I think there would be none if proper care as to cooling the milk down rapidly, and cleanliness of vessels and decent rapidity of transit were observed.

4802. Do you think that some improvements upon the present system of drawing and storing the milk, and of the transmission of the milk are necessary in some instances in order that preservatives might be dispensed with?—I am not sufficiently acquainted with the dairy farms of the country now, but from second-hand information I should say that small farmers do not always observe those rules. Those conected with large milk suppliers and large companies are obliged to use refrigerators, and to observe precautions which in the vast majority of instances are sufficient to ensure the delivery of the milk in London in a useable condition, no preservatives having been added.

4803. Do you see any objection to the supply of milk which has been indiscriminately preserved with one or another preservative to sick people in hospital?—Certainly.

4804. What are your chief objections upon that ground?—The evidence as to the action of the chief preservative used, which is boracic acid, is, as you are aware, extremely conflicting. The whole thing wants re-investigating, experimentally, on a large scale. In view of the fact that a great many experiments have shown that the digestibility of milk in the various fluids of the body is affected by the use of preservatives, I think the use of such milk is inadvisable for sick persons. With regard to other preservatives, the only other preservative I know to be used, and largely used now, is formalin. I had formed the opinion that probably it was not much injurious, if at all, in small quantities. That was my opinion at first, that its use in small quantities was not much objectionable—I would not say not objectionable at all. But from what I now know of its hardening effect upon albuminous bodies, gelatin and other nitrogenous bodies, I suspect that the digestibility of the milk would be a good deal affected by the use of formalin. My chief objection to the use of preservatives in milk—I absolutely object to them in milk altogether—is the use of these foods for infants. Milk which, of course, must be the staple food of infants, is so very readily affected as to its nutritive powers by anything done to it, for instance, in the view of many eminent medical men in this country and in America, children as a rule cannot be brought up on sterilised milk. This is an opinion held by others that sterilised milk has a tendency to innutrition; there, where nothing is added to the milk an affect is produced probably on the albuminoids, which differ in various kinds of milk. One would expect that anything which affected the solubility of those albuminoids—as formalin undoubtedly does—would seriously impair the nutritive quality of the milk for administration to children. The evidence, to my mind, as to the injurious effects of boric acid on adults in small quantities is very doubtful. I think probably you have had or seen brought before you the recent experiments of Dr. Annett in Liverpool, which were published in the "Lancet" in November, where he showed that on feeding kittens on a borated milk a certain number of those kittens ceased to gain weight, others lost weight, and a considerable proportion of them died.

4805. Would you attach considerable importance in your expression of opinion to the evidence adduced by Dr. Annett and Professor Boyce?—I think that is extremely valuable, and I think this Committee should hesitate altogether until those experiments are carried out on a larger scale, and confirmed or refuted.

4806. Now, before passing on, with regard to the hospital, are we to take it that you think it would be undesirable generally to administer preserved milk to invalids, or that you have objection to the administration of substances which are used as preservatives in certain diseased conditions?—I object on general grounds. A sick person whose absorptive and assimilative functions are in abeyance or diminished is more in the position of a young child; such a person cannot digest things which the healthy adult can digest.

4807. We are told that as much as 80 grains of boracic acid has been found in a pint of milk. Would you care as a physician to administer milk containing that to a case of typhoid fever?—I am not a practising physician now, but certainly if I had typhoid I should very much object to that quantity.

4808. Would you object to give the milk containing that amount of boracic acid to a case of acute nephritis?—Yes.

4809. Why?—I know that boric acid is excreted through the kidneys, and rapidly excreted—at all events the major portion—and a non-natural constituent of the body passing in this way through the kidneys would be likely to affect them in the case of nephritis; it would increase probably the flow of urine and the irritation.

4810. You see a danger in the indiscriminate use of boric acid in that a certain number of the public affected with certain illnesses might be prejudicially affected?—Yes; that is especially the case with regard to another preservative—salicylic acid, which is not much used for milk, I believe.

4811. You say in your synopsis with regard to the experiments which you think this Committee should undertake, that we should observe the effects upon animals of the use of preservatives?—I think that is required.

4812. What animals would you suggest?—Certainly young animals; but I think those should be selected by a physiologist.

4813. Young animals in the condition of taking milk?—I think so with regard to milk.

4814. Do you think monkeys would prove as satisfactory a test as we can get outside the human species?—Probably they would.

Dr. T. Stevenson.

17 Jan. 1900.

4815. Do you think they would be more satisfactory than dogs or kittens?—Possibly they would, if you got a sufficient number of young monkeys. I do not know that it is possible to carry that out.

4816. (*Dr. Tunnicliffe.*) It would be very difficult, anyhow?—There is this objection to monkeys; in this country they are living under abnormal conditions, and monkeys of all kinds in the Zoo, I know, are very apt to die very unaccountably, and to go off very rapidly. There is an objection there.

4817. (*Dr. Bulstrode.*) Do you think the mortality of monkeys in the Zoological Gardens is a fair inference of what ought to be?—I suppose they are kept there in better conditions than any other monkeys in the country. I should think so, and I hope so.

4818. I have had a monkey for two years, and it is quite well?—A monkey has been in the Zoo for years, and remained well, but they will die very unaccountably.

4819. And die very rapidly?—They die of pneumonia chiefly, I think.

4820. Do you think it would be necessary to obtain a licence from the Home Secretary to perform such feeding experiments in regard to animals?—Certainly. I have had experience of that. I had a licence at the end of the year (it is not renewed yet), and at one time was licensed to feed cats and dogs. There is a great difficulty in getting the necessary certificates for these experiments. To feed an animal is an experiment if it may be reasonably expected to result in pain, and I apprehend that if the animal lost flesh and died from kidney affection or from mal-nutrition that that would be an experiment under the Act "attended with pain." I do not speak only from my own knowledge. A good many years ago I had occasion to consult with reference to giving feeding experiments in connection with a poisoning case, and I had very high legal authority that such experiments could only be performed by a licensed individual.

4821. You refer to the fact that occasionally boric acid in small quantities in food produces nausea; can you give particulars as to that?—No. I know of no cases myself, but I have seen it given in evidence by public analysts, and I think by others, that they have taken 5 grains, and so on, and they have been nauseated. I do not attach much importance to that.

4822. You have not made experiments in that way yourself, have you?—I have tasted borax and boric acid; but I do not think in most kinds of food you would taste boric acid except it were in an excessive amount.

4823. Will you give your views to the Committee on salicylic acid used as a preservative?—Certainly. Salicylic acid does affect some people very considerably. I know a physician, who, if he were to take 10 grains of salicylic acid as a test it would bring down his pulse ten beats in a minute within a short time; others have found it affect their kidneys. There is a great difference of susceptibility to the use of salicylic acid as you of course know, and it is not always innocuous.

4824. That would be one of your reasons for objecting to its indiscriminate use?—Yes. I have not examined salicylic acid lately; but there used to be a good deal of impure salicylic acid on the market. We know from the experiments of Dunstan and Black that the meta- and para-toline acids which have been found in it are very potent agents. Still many people take salicylic acid habitually without any effect whatever. I should like to illustrate that by saying that we must not suppose that because a large number of people take a particular article it is necessarily non-injurious. Take the effect of lead in water. We know from the Sheffield epidemic and others that only a fraction of the people drinking the same lead-polluted water suffer. You could select dozens and dozens of people, and houses in that town, where the people were drinking lead-polluted water, and yet did not suffer. That would by itself lead to the conclusion that lead-polluted water was non-toxic.

4825. Am I right in assuming that the extent of lead poisoning was found to be much more widely prevalent when public notice was directed to the possibility of lead poisoning?—I do not quite remember that; probably it was. No doubt many people would be suffering from lead poisoning who did not know what they were suffering from.

4826. You say in your synopsis that "milk which is almost but not quite turned is ill-adapted for infants for it has undergone undefined changes in its normal constitution." Do I understand you to mean that the lactic acid changes are not the true indication of the other changes which will take place in milk?—I think generally they are, but the change may have advanced not quite far enough to produce enough free lactic acid to be readily detectable. The milk is then normal in appearance, and probably most people would take it without suspicion, but if you keep it an hour or two longer it turns. I do not think that such milk on the point of turning is advisable for the feeding of infants. There is another objection to the addition of boric acid to milk in order to preserve it for two or three days. It enables the milkman to pass off stale milk as fresh. Certainly, if you buy new milk, or fresh milk you do expect to get milk which is not twenty-four hours old; if it is forty-eight hours old I think the purchaser is prejudiced.

4827. Even if there has been no bacterial action going on?—No obvious bacterial action; one cannot say that none has gone on in milk under such conditions.

4828. What would you term fresh milk; would you confine your statement exclusively to milk freshly drawn from the cow, whether or not it has undergone changes?—I should say, roughly speaking, it is milk which is freshly drawn from the cow.

4829. With regard to the use of formaldehyde, will you give the Committee your views upon that?—I have seldom found it in milk. In all the milks I examined from September, 1898, to September, 1899, it was only found in one half per cent. of the cases, which is very few indeed, so that one does not often meet with it. It can only be used in small quantities without detection by the odour, especially if the milk is slightly warm; and it is very perceptible. Formaldehyde is a potent chemical agent, even in a minute quantity; for instance, if you have been dissecting, or have got any foul odour on your hand, a minute quantity of it acts chemically, and removes the odour. Such a small quantity in making pathologic preparations would harden the tissues. If you put a few drops in a tumbler of water, and put a specimen in it that will, as you know, probably destroy its value. Take, for instance, its use in photography on account of its hardening power in hardening the gelatin film. In very small quantities it does alter these nitrogenous matters so profoundly that I should object altogether to its use in milk on that account.

4830. Even if it were allowed to be used, you would strongly advocate, I take it, that it should be strictly limited in amount?—Yes. I heard what Mr. Fisher said on the amount. The difficulty is to determine the amount when present in minute quantities.

4831. You agree with Mr. Fisher that it is very difficult to estimate?—Yes, and it does disappear in time. It is very difficult to say how much has been added, certainly. It is difficult to say how much is present, and it is much more difficult to say how much has been added.

4832. Then generally speaking you object to the use of preservatives—may we take that as your position?—Yes, I think it would be well to prohibit them, although on health grounds I see no considerable objection to the use of boric acid in very minute quantities, in butter and probably a few other articles. The amount of borates taken per diem, say in butter, is so small that I do not see that any serious objection lies to that, except on this ground, that if you say a third of a per cent. in butter may be permitted, you cannot be certain the person does not take boric acid in his milk, boric acid in his salt fish, and boric acid in his bacon, and so you do not know how much he gets in the course of the day.

4833. Do you think the chief objection to the use of preservatives is with regard to their use in milk?—That is my strongest objection. I do see objections with regard to other articles of food.

4834. You would have less strong objections with regard to such things as bacon, because of the relatively small amount which might be consumed?—With regard to bacon I do not know; I have never had bacon brought to me to examine, and I do not know the amount found in bacon.

4835. 0·6 per cent. has been found?—That works out to a good deal. Thinking it over again and again, I think an adult person should not have more certainly than 10 or 15 grains of boric acid per diem under any circumstances.

4836. An adult?—Yes; but it is difficult to work that out on different kinds of food.

4837. Will you tell us your views as to the use of colouring matters—artificial pigments?—I think that the alterations in the kinds of colouring matters used of late years, more specially with regard to sweetmeats, have been on the whole advantageous. One now never meets with such things as chromate of lead and arseniate of copper, nor any mineral pigments, except copper in green vegetables. That is undoubtedly a great advantage. There are certain dyes which are said to be used, but I have not met with them myself, such as Bismarck brown, which are undoubtedly poisonous in no large quantity. I have examined a great many sweetmeats from time to time, not only under the Act, but with regard to Home Office work, and I have never been able to find any dye which I knew to be noxious.

4838. How many years of experiments are you speaking of?—Extending over the last 20 years.

4839. During the last 20 years you have never in the course of your experiments discovered what?—Any colouring substance which I knew to be poisonous; but then the quantity used is so small that it is as a rule impossible to absolutely identify any particular dye. It is, say, one in 100,000, or 200,000, or 300,000 only. I have found the only dye which I have been able to extract in large quantities from sweetmeats is a dye called rhodamine which has been taken in much larger quantities than would colour a pound of sweets without any obvious effect. Some of my assistants have taken it and other people have taken it, with no obvious effect, say, doses of two or three grains, which would colour an enormous amount of sweets. Then, again, other dyes are used, for instance, in butter, the tropeolin dyes, and jellies are dyed with some of the eosin dyes. I do not know whether these are injurious in the very minute quantities which are sufficient to colour these sweetmeats. They are often what are called the nitro-compounds, and we know generally that those are, as a rule, toxic.

4840. With regard to the use of copper in peas, have you formed any opinion, or have you any experiments to put before the Committee in that direction?—The amount of copper in peas now, as a rule, is much smaller than it formerly was; it used to be equivalent to about 2½ grains or 4 grains of sulphate per pound, about a fourth of which would be copper; that is an unnecessary quantity. I have dyed vegetables with half or a third of that amount and got a good colour. One usually finds very little copper in peas nowadays.

4841. What would you advocate as regards the regulation of the use of colouring matters?—I think that the use of copper in peas should be prohibited; it is unnecessary.

4842. Generally, what regulation would you advise in respect to colouring matters?—I do not know that I could lay down any regulation, for the kind of colouring matter varies from month to month; they are always introducing new dyes, and it is difficult to say what one should prohibit and what not. The use of colouring matter in such things as confectionery is, I suppose, a necessity; it is the colour of the dye which attracts in a great measure.

4843. You know that in Belgium and in some other countries there are schedules drawn up as to what are regarded as noxious colours and what are regarded as innocuous?—Yes, I think this Committee might very usefully draw up such a schedule, but they would have to make experiments to see which are noxious and which are not.

4844. Do you think before any schedule can be drawn up that it is absolutely necessary to have experiments?—Yes, I think so. I do not know of any information with regard to the physiological effects of nine-tenths, or ninety-nine hundredths of the dyes of commerce.

4845. Do you know whether, for instance, the schedules to which I am referring have been drawn up on a basis of experimental evidence, or on general principles of what is known as to the poisonous doses of certain dyes?—Probably both. In the case of some dyes the poisonous effects are known, but they are very few. What is the effect of minute doses of many of these dyes I do not know, and I have not been able to get the information; it may exist but if it does I am ignorant of it.

4846. (*Dr. Tunnicliffe.*) Do you think that the scientific exponents of the country would be satisfied by the result of a series of experiments upon animals on this individual question?—I think they would be very grateful for it, and it would be extremely valuable. Whether it would satisfy everyone I do not know, but I think I may say that we have been looking forward to some experimental evidence being adduced to settle many of the conflicting controversies.

Dr. T. Stevenson.

17 Jan. 1900.

4847. What I should like to ask your advice about is whether you think that such experiments if performed upon animals would have weight with that individual party whose views did not happen to be supported by the experiments?—If people have unjudicial minds I do not know how you can convince them; but I think that medical men, as a rule—the men of standing in the medical profession and in the chemical profession—would hail with satisfaction a series of experiments conducted by independent observers on a sufficiently large scale. The experiments on animals might not be, and probably would not be, altogether conclusive, but I can suggest nothing better than such experiments.

4848. Do you know if we should be right in assuming that infants, apart from the question of body weight, are more susceptible to the action of either boracic acid or formic aldehyde than adults?—I quite think that.

4849. You think they are, apart from the question of body weight?—I think from the quickness with which they have to digest their food and to assimilate it, that anything which interfered with that digestibility and assimilability would necessarily have an injurious effect on the growth and nutrition of the child. You know that their processes go on much more actively and rapidly than they do with adults, and therefore they are not able to digest the same food.

4850. From a physiological standpoint would you regard the child as a more irritable reagent than the adult?—Yes.

4851. (*Dr. Bulstrode.*) There is just one other point—you have told us quite rightly that fresh colouring matters and probably fresh preservatives are being introduced from time to time?—Yes. I said colouring matters, but occasionally fresh preservatives are used as mixtures.

4852. Therefore any conclusion come to by this Committee with reference to the preservatives and colouring matters which are at present in use could only, of course, apply to such colouring matters and such preservatives; how would you propose to deal with the newly discovered colouring matters?—I think that would not be an insuperable difficulty. Somebody—some Government authority—should, with regard to the scheduling of poisons, be deputed on evidence to admit fresh preservatives or fresh colouring matters, and fresh colouring matters and fresh preservatives should not be introduced without the sanction of that authority.

4853. It has been suggested that there should be a sort of Court of Reference, with members nominated by certain Government departments and others, to whom these subjects should from time to time be referred and by whom they should be decided; do you think that would be a feasible method of administration?—I think it would; I could not suggest a better method. It seems to me a very valuable one.

4854. Is there any other matter you would like to bring before the Committee?—No. You have had my proof, and I do not remember whether I have omitted anything that is in it. Remember that I am speaking my own views. I come here for the Society of Public Analysts, who asked me to do so, but they laid no instructions upon me. I said I should confine myself mostly to health effects as one of the few medical men belonging to that body. I am very strongly of opinion that experimental work (I speak very respectfully) should be carried out by this Committee, or under its direction, in some way to settle many of these debated questions. In regard to opinions formed simply by hearing what Mr. A. says on one side and what Mr. B. says on the opposite side, if you come to a final conclusion on that alone, I respectfully suggest that your findings will not meet with the acceptance from scientific men in the country that they would otherwise receive.

4855. But you think that would be met to a certain extent by a series of experiments on immature animals?—I do not say immature animals.

4856. On any kind of animals?—On mature and immature, both.

SEVENTEENTH DAY.

Thursday, 18th January, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart, M.P., F.R.S. (*Chairman*).
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. T. F. Blackwell.

18 Jan. 1900.

Mr. THOMAS FRANCIS BLACKWELL, called; and Examined.

4857. (*Chairman.*) I understand you are a partner in the firm of Crosse and Blackwell?—Yes, I am the chairman of that company.

4858. You are aware of the nature of our inquiry, it is two-fold—first into the use and effect of preservatives, and, secondly, into the use and effect of colouring matters in articles of food?—Quite so.

4859. Do you think you can assist us by the results of your experience and practice?—I think I might give you some information upon some articles of food as to colouring, and so on. Of course, you have inquired into a great many articles of food with which I am not practically acquainted.

4860. I suppose you could tell us something about preserves?—Yes.

4861. And pickles?—Yes.

4862. And other condiments?—Yes.

4863. We will take preservatives first. Is the use of modern preservatives very general in preserved fruits and jams?—I should say not as far as my knowledge goes. We do not employ them at all.

4864. Is it within your knowledge that they are employed?—No, it is not within my knowledge. I know that such articles are offered to us to purchase, but whether other people use them or not I cannot tell you.

4865. In short they are quite unnecessary?—Quite.

4866. If a manufacturer has a quantity of fruit which threatens to go bad in hot weather I suppose he might in certain circumstances save that fruit by the application of a preservative?—In this way, that if more fruit was delivered than you have made up with sugar into jam on the same day the probability is that any manufacturer would put down the pulp by boiling it in the first instance, and putting it away into what are known as stock tins, that is into two gallon tins. There is no preservative added to it at all, but it undergoes a preservative process of heat.

4867. Would you be inclined to advocate any restriction or prohibition of the use of preservatives?—I do not know myself that they are in use in that way—not the chemical preservatives. There are two methods, as far as I know, of preserving fruit in the pulp form. One is the way I have just mentioned, which is by boiling the fruit pulp and putting it into two-gallon tins, when it undergoes a preservative process of heat, but no chemical whatever is added. The other method is by boiling the fruit in the same way, and putting it away into large bottles or casks, in which case the bottles or casks are fumigated with sulphurous acid gas.

4868. Do you manufacture potted meats or potted fish?—Yes.

4869. I suppose we may assume that in some instances preservatives are used?—No, no preservative of any kind is used by us.

4870. Not by you, but we may assume by others?—I cannot assume what other people do.

4871. When I tell you that out of 2,984 samples of various articles of food, including brawn, preserved fish, jam, preserved fruit, preserved vegetables, lime and lemon juice, cordials, syrups, and so on, a certain proportion of each of these articles that I have mentioned, except preserved fish, has been found on analysis to contain either boric acid, salicylic acid, formalin or sulphates, I suppose that we may assume that they are used to a certain extent?—It is clear that they are used in those cases where they have been found; but I muststate fo rmy own firm—and I can state for other firms of reputation—that they in no case use any of those preservatives.

4872. Then they are quite unnecessary?—Quite.

4873. Do you think they ought to be prohibited?—I do not say that if they are used in moderate quantities.

4874. Do you think a declaration ought to be made on the label?—Yes, I see no objection to that. I think that should be done in all cases when a thing is used of that nature.

4875. I do not want to be unduly curious, but could you tell us if there is any article which you manufacture in which these preservatives are found to be necessary?—No, we do not use them at all. I should tell you perhaps that we sell all our potted meats and articles of that kind in hermetically closed vessels—tins or jars. They all undergo a process of preserving by heat, and any chemical addition is quite unnecessary.

4876. Then we will turn to colouring matters; there are certain trade customs to which the public have been used. We have been informed that the public like vegetables and preserves to be of an attractive colour; is that in accordance with your experience?—Yes, if you are referring to preserved peas and beans, and vegetables of that character, which are generally preserved abroad—there are a good many preserved in England now, I believe—they are in most cases coloured, I suppose with sulphate of copper, and that is done because the public demand it. We have sold for a great many years one preserve of peas—for a great number of years we sold no other—where the manufacturers have never at any time used any colouring; but our sale in this country has been extremely small, scarcely anything, although we have sold a large quantity abroad. They put on every tin of their goods that label. (*Handing in specimens.*)

4877. But they are not popular in this country?—Not at all. The sale is extremely small in this country. There is a considerable sale for export, and they are a firm of a first-class character.

4878. Would you see any objection if the necessity were imposed of declaring that an article was artificially coloured?—No, I think it should be so declared. We did not for a great many years, but we now sell French vegetables in bottles; they are all slightly coloured, and we state in our price list that these vegetables are prepared in France and are artificially coloured. We should be quite prepared to state that on every bottle.

4879. There are certain colouring matters used in jams are there not?—The only colouring matter that I know of as being used is extract of cochineal.

4880. That is a harmless colouring matter?—I believe it to be perfectly harmless, and the object of using it is really to get uniformity of colour. You will understand that the deliveries of fruit on any given day will vary in appearance somewhat, and it is very desirable that there should be uniformity of appearance. To gain that uniformity of appearance it is necessary to use a very small quantity of this extract of cochineal. I daresay other colourings may be used, but I have no knowledge of it, although we are continually having aniline colours of various kinds offered both at home and abroad.

4881. Strawberry jam, I suppose, made in a factory, is of a somewhat brown colour?—Not necessarily. It ought not to be, because the strawberries reach us from Kent the same day that they are gathered; we get deliveries as early as 11 o'clock in the morning, of fruit that has been gathered very early the same morning in Kent.

4882. And they retain the bright colour?—Not necessarily, because, as I say, even the difference between a sunny day and a dull day will make a difference, as you know in your own garden, in the colour of the fruit. It may be excellent fruit, but yet it may not have a very full colour.

4883. For trade purposes it is necessary to have a uniform colour?—Yes, the public prefer to buy an article that has a uniform appearance, flavour, and so on.

4884. Do you manufacture any temperance drinks?—We manufacture an article called lemon squash. We manufacture that entirely from lemon juice and sugar; we do not add anything to it; we do not use any chemical for it.

4885. Orangeade?—No, we do not make that. We sell large quantities of bottled lemon juice, and we do not add any chemical to it, but it has this disadvantage—we get complaints now and then that it is liable to turn mouldy, which it will do when it is pure lemon juice; it turns mouldy very quickly when the cork is taken out, and the bottle is partly emptied. The number of complaints is few, and we always explain that it is not possible to prevent it, without the addition of some mineral acid which we think would be injurious. I may state as regards pickles, as far as I know, they are never coloured now, and have not been for the last 40 years anywhere in England.

4886. To go back to preservatives, do you know if the use of a preservative in lime juice or lemon juice would be convenient?—Yes, I think it would; it would prevent as I say the mould appearing when the bottle is opened.

4887. Is it very largely used?—I should say that it was.

4888. Would you be surprised to hear that out of 75 samples tested at Somerset House 88 per cent. contained either boric acid or salicylic acid?—I am rather surprised to hear that such a large proportion did, but I should expect to find the larger proportion to contain it.

4889. Have you any experience of other colouring matters besides cochineal?—No, the only other article that I know of in our business that is coloured is the essence of anchovies. That is coloured to give it a pleasant appearance. It is coloured with a red earth, and has always been. We tried years ago to introduce an uncoloured essence of anchovies, but entirely without success.

4890. (*Dr. Bulstrode.*) Is the firm which you represent the largest of the firms carrying on that particular line of business?—I should not wish to claim that. We are one of the largest.

4891. Do you think that the public dislike the use of colouring matters and preservatives?—No, I do not think they care the least in the world about it. I think if they get something that is pleasant to the eye and to the taste they do not care whether it is coloured or not; in fact, I think they rather demand the pleasant looking article.

4892. Are there not some firms which advertise no colouring matter and no preservatives used in their jams?—Yes.

4893. What would you say would be the reason for that if there is not some prejudice in the public mind against the use of both colouring matters and preservatives?—I do not think there is a prejudice at all.

4894. You know that in the case of Pink's jams, for instance, they advertise no artificial colour and no chemical preservative?—Yes, I have seen that advertisement.

4895. You do not think it is necessary yourself?—No, I do not; not as guiding the public.

4896. Do you know anything as to the methods of adding copper to peas?—No, I do not.

4897. You said that your firm would have no objection to its being made compulsory that the presence of preservatives should be declared on the label?—No, not at all.

Mr. T. F. Blackwell.

18 Jan. 1900.

4898. Or colouring matters?—Or colouring matters.

4899. Would they have any objection, do you think, to the nature of the colouring matter or preservative being stated?—No, I should say not.

4900. And they would have no objection, if possible, to state, if it was thought necessary, the amount, the percentage?—I think not; I do not see any objection to it.

4901. (*Dr. Tunnicliffe.*) Do you add the copper to the peas yourself?—No, the peas are preserved in France, and come over ready for the public use. We do nothing with them except to distribute them.

4902. Do you employ an analyst?—Yes, Professor Dunstan is our professional adviser.

4903. Do you employ an analyst constantly?—We do not employ an analyst continually on our premises, if that is what you mean, but any matters that we wish to be advised upon we refer to Professor Dunstan.

4904. Do you employ a chemist on the premises?—We do not.

4905. Do you make jam from imported pulp?—No, we do not.

4906. You do not?—Yes, one kind only—apricot.

4907. Where is that pulp supplied from—I do not want any names, but where does it come from?—The best apricot pulp comes from France, from California, from Italy, and from Spain.

4908. Does that pulp contain a preservative?—I do not think it does. I believe I have seen pulp that has contained a preservative, but we always endeavour to buy it quite free from any preservative. It is quite unnecessary to put in a preservative.

4909. Do you take means to know that it contains no preservative?—Yes, we do. When we have a suspicion of a preservative we have it analysed.

4910. What would suggest to you a suspicion?—The flavour.

4910.* The flavour?—Yes, there would be a flavour.

4911. You think you could detect by the flavour of the pulp whether it contained preservative or whether it did not?—I would not say "detect it"; it would cause a suspicion of its presence.

4912. Anyhow, you would be quite certain there was not one there if it had a certain flavour?—I should.

4913. And such a pulp you would not send to be analysed?—I should not send it to be analysed.

4914. You say the importation of pulp is perfectly feasible without a preservative?—Quite.

4915. Of any pulp?—Yes.

4916. By methods such as you have?—Yes.

4917. I do not want to ask any personal question, but I suppose your trade is a high class trade?—Yes, it is.

4918. Do you think, in the case of a lower class trade, that preservatives are unnecessary?—What do you mean by unnecessary?

4919. Would you regard those opinions to which you have given vent, with reference to your own individual trade, as applying to a lower class trade than yours?—I should say so. I should think that all these various articles can be preserved, and preserved perfectly, without the use of chemical preservatives.

4920. Would the authorisation of the use of preservatives cheapen the price of jam?—No, I do not think it would at all; I do not think it would make the slightest difference.

4921. Do you think the public would still have to pay the same price for their jam?—Exactly. I do not see where the saving would come in at all.

4922. You do not think, for instance, that fruit could be utilised by the use of a preservative that would otherwise have to be wasted?—No, I do not think so.

Mr. John Tubb-Thomas, called; and Examined.

Thomas.

4923. (*Chairman.*) You are County Medical Officer of Health for Wiltshire?—Yes.

4924. And Licentiate of the Royal College of Physicians and Royal College of Surgeons, Edinburgh, and a Diplomate in Public Health and State Medicine?—Yes.

4925. You have had an extended practice both in public health and as a general practitioner?—Yes, more especially amongst the middle class and the working classes.

4926. I believe you have directed some attention to observing the effect of some of the modern preservatives

Mr. J. Tubb-Thomas.

18 Jan. 1900.

which are employed, especially in dairy produce?—Yes, more especially since about eight or nine years ago, and during the time I was partly in general practice as well. I then found the serious results of the use more especially of boric acid in milk amongst children. At that time I had children under treatment suffering from diarrhœa, and also from convulsions and other forms of disease in children; I prescribed boric acid for these children with their food in small doses, one to three, four, or five grains—at the outside five grains—and I found that the children, instead of improving, got worse, the diarrhœa increased, the children became emaciated, and some of them died.

4927. Could you tell us where you were in practice?—In Newport, Monmouthshire.

4928. That is an industrial district, is it not?—Yes, it is an industrial town. The part of the town where I was living in was the newer part of the town, which was inhabited almost entirely by the working classes. Upon making inquiries further into the matter, I found that the milk that was used by these children contained a further portion of boric acid varying from 40 to 80, 100, and 120 grains or more per gallon.

4929. Did you ascertain that by quantitative analysis?—Yes, and also in a better fashion still, by interviewing the milkmen and getting from them the quantity of preservative that they were using with their milk.

4930. Then the preservative was not added by the consumers?—It was added by the milkmen. It was not used in the name of boric acid, but it was used in the names of the other forms of preservatives with fancy names, which are largely composed of boric acid. I experimented then with the use of boric acid upon myself. I found, although in good health at the time, that taking boric acid in doses, beginning with five grains and working up through ten, by the time I got to fifteen grains three times a day my digestive organs were absolutely upset. It produced, first of all, a form of pyrosis, and then sickness with diarrhœa and a certain amount of headache; and after a while the quantity of urine was greatly reduced, and there was almost complete suppression of urine eventually. This same train of symptoms I have found since when I have taken articles of diet that have been found afterwards to contain boric acid. For instance, last summer I was knocked up with a pork pie which contained a large quantity of boric acid, and I am firmly convinced that it was the boric acid that caused it; but still there might have been some other cause, and I will not altogether give the boric acid absolutely as the cause of that illness; but in cases of milk, when I have been put on a milk diet, and I have taken milk containing boric acid, it certainly has upset me.

4931. Have you found it caused a certain skin eruption?—You get a certain amount of eruption of the skin, but it has never produced any disagreeable eruption of the skin.

4932. What conclusion did you come to as to the necessity for regulating the use of these preservatives?—I have come to the conclusion that boric acid certainly should not be used in milk. I have taken great interest in the subject, and I have followed the milkmen down the street, and I have made inquiries into the matter. I find that considerably more than 85 per cent. of the milk that is consumed in a street inhabited by the working classes is used by very young children or by persons in indifferent health. The working classes of England in our manufacturing towns do not use milk so much as an article of diet; they use it chiefly for the purposes of colouring or flavouring their tea or coffee, as the case may be. Those persons who habitually do use milk, and use it in quantity, are, as a rule, persons in indifferent health. I know my own experience in the matter is that quite 85 per cent. is used by young children and persons in indifferent health. Then again, I found that boric acid is not used so much by the high-class dairyman as it is by the man who gets over-day milk, and possibly this milk has been doctored with boric acid before he gets it, and he gives it a further dosing of boric acid to carry it over.

4933. These boric compounds are also in use, are they not, in private houses?—Yes, they are undoubtedly used there. Cooks use them. They are sold as "Frigilin," and under other fancy names, and if you get a professed cook she knows these forms of preservative, and she adds them to articles of diet without your knowing it.

4934. Then do you advocate the total prohibition of their use in fresh milk—in new milk?—Yes. I say again, apart from that it is absolutely unnecessary to use them—absolutely.

4935. Even in the milk supply of a large town?—Even in the milk supply of a large town. I contend that all the large towns of England can be supplied within a reasonable radius with milk without the use of preservatives.

4936. That would entail, I presume, certain precautions on the part of the vendor and purveyor as to greater cleanliness?—Not as to greater cleanliness, but as to the absolute cleanliness that should in all cases exist in the treatment of milk.

4937. What I mean is that in the absence of a preservative perfect cleanliness becomes a necessity?—Absolutely so.

4938. Whereas the cleanliness need not be perfect where preservatives are used?—A preservative is an argument for filth in other words. In addition to that, of course it is used in all other forms of food. For instance, if you get your poultry from the poulterer he dries it with a compound of boric acid and flour, and that sort of thing. I am firmly convinced of this, that a very large number of the medical men in England, if they knew more about the subject, would have been able to give you evidence very clearly upon the point of the injurious effects of boric acid, but I am sorry to say that a very large percentage of the medical men in England do not know much about the subject, and those that do have been misled by the information that has been dispensed by the Boric Syndicate. Of course, you have seen this book which has been distributed throughout the country (*producing a pamphlet entitled "Boron Food Preservatives and Their Influence on the Human Organism; being a Collection of Medical and Scientific Data on the Subject"*). I am sorry to say that what a large number of medical men know about boric compounds they simply take from that book, and the evidence in that is not altogether satisfactory. That book has been distributed gratis post free to a very large number—indeed, to the greater portion of the medical men of England.

4939. What is the source?—It comes from the Boric Syndicate—a syndicate of Americans and Canadians who are interested in the boric compounds. I do not know whether that book has come into your possession before. You will observe that on page 54 Mr. Walter Iliffe gives a testimonial, in which he says: "It must, however, be administered with method, *i.e.*, not too soon after food, but rather half-an-hour before."

4940. But this is speaking of a chemical administered as a medicine?—Just so. If administered as a medicine, it does harm when administered too soon after food; surely it will do harm when it is administered with the food.

4941. At any rate, it is not an article that ought to be used indiscriminately?—It is not.

4942. Nor without the knowledge of the consumer?—It is not. Then, apart from that, take the people who use these preservatives. The poor farmer or the retail milkman is a man not always of good education; he is given to understand that this compound is perfectly harmless, and he goes upon the old saying, "If a little does good a lot will do more good," and he uses it irregularly, and he uses it by rule of thumb. For instance, I have had a case recently where some milk was taken by one of our inspectors for analysis, and this man admitted that he had used two table-spoonfuls mixed with half a pint of water in a can of milk containing about four gallons. Yesterday I made some rough estimations of what a table-spoonful of boric acid weighs, and I found that a heaped-up table-spoonful will average from 450 to 500 grains, which is about 125 grains per gallon. I levelled the table-spoonful—a table-spoonful swept off will contain from 350 to 360 grains—that is, equal to nearly 90 grains per gallon.

4943. Was that pure boric acid?—It was pure boric acid. Others that I found using it used a small measure. I know in one instance they used a small tin measure about the size of a four-ounce deep chip box that held nothing else but boric acid, and that is used in a 17-gallon churn of milk.

4944. Apart altogether from the question whether borax is a harmless or injurious substance to the consumer, it enables farmers to carry on the dairy trade under improper conditions?—Yes, and upon premises and farms that are absolutely unsuitable for dairy farms.

4945. And which render the consumer liable to injury from other sources?—Yes.

Thomas.

Jan. 1900.

4946. Besides the direct injury from the preservative?—Decidedly so. Another contention that I make is this: As a sanitarian, and one looking after the sanitation of a large county, more especially of a milk producing county, if the use of preservatives is allowed, especially preservatives in any quantity that the person chooses to put in, I think it is simply putting back the clock as far as sanitary improvement in our rural districts is concerned.

4947. You acted, I think, at one time as Medical Officer of Health for Leicestershire and Rutland?—For the large combination of Leicestershire and Rutland, yes.

4948. Did you notice the same prevalence of preservatives there?—Yes, and I found this, that in the case of the men who were compelled to use preservatives when one came to examine their premises one found that their premises were unsuitable for the purpose of carrying on dairy farming; their surroundings were not at all satisfactory, the cowsheds were not right, there was not the care in the milking that there should be, neither clean hands nor clean vessels, and, apart from all that, there was a paucity of a good water supply. Then, in addition to that, their means of refrigeration and cooling their milk, or attempted cooling, was very crude. I found there was a refrigerator put up in one instance right against the wall of a common privy with an open cesspit close at the back. In other places you find it put up in a rough shed in a dirty yard, the source of the water used for pumping for refrigeration being extremely dirty. I found the same thing even in some cases in Wiltshire. Then, of course, there is the liability of leakage in the refrigerator.

4949. It has been suggested that a declaration should be exacted from the vendor of any substance containing these preservatives?—I think that would be absolutely futile and would do no good whatever; it would do considerably more harm than good, for this reason: If I am rightly informed the boric compounds in England are very largely in the hands of a wealthy syndicate, and if they go to the trouble of sending an expensive document, like the pamphlet I have shown to you, to the medical men in the country, they will go to equally the same trouble in distributing evidence of the same description amongst the poorer classes. The poorer people will be told that their milk, instead of being spoilt or damaged by the use of preservatives, will be improved and better for them, and they will be told—and rightly, as they would find it—that their milk will keep longer. I admit it keeps longer, but I say it is a disadvantage that the milk should be kept in the circumstances that it is kept in by the poorer classes in England. My contention is that, instead of an effort being made to preserve milk, one should encourage the rapid use of milk as much as one possibly can; it should certainly be used by all consumers within forty-eight hours of its production, and it can easily be done so.

4950. Now what you have said so far refers entirely to milk and cream—are you of the same opinion as regards the use of preservatives in butter?—Perhaps not to the same extent.

4951. Because the consumption is not so large?—Yes, and then again I quite agree that it is not possible that a big town can be supplied with fresh butter from its immediate neighbourhood, and therefore butters must come from a distance. Personally, I should prefer to go back to the old Irish salted butter, but the taste in these days certainly is for milder butters, just the same as it is in bacon and things of that description.

4952. Are you aware of any difficulty in supplying a town with perfectly fresh butter, irrespective of distance?—Yes, I think there is a difficulty.

4953. In what does it consist?—If butters were sent into the market at certain times of the year they will certainly become tainted, and the taint can be tasted.

4954. It is the case, is it not, that a very large quantity of Danish butter is sold in this country?—Yes, a very large quantity.

4955. And the use of preservatives is absolutely prohibited in Denmark?—Possibly so; it was not some time ago, but it may be now.

4956. I think you may take it from me that it is; there is no difficulty in maintaining the supply of Danish butter, is there?—There is not the slightest difficulty. Of course, some of the Australian butters undoubtedly contain preservatives.

4957. Are you aware that some of the large creameries in this country send up their butter perfectly free from preservatives?—I know many creameries that use preservatives.

4958. My question was whether you know of any that do not use them?—I do not know of any.

4959. If you found it to be the case that certain large creameries never put preservatives in butter, would your opinion of the difficulty of supplying large towns with fresh butter be modified?—Yes. Of course, it is quite possible, if butter is made perhaps on the Devonshire system, with scalded cream, that every town could be supplied easily.

4960. I did not say scalded cream, but absolutely fresh butter?—My opinion would be modified then, certainly.

4961. Now, what have you to tell us about colouring matters in dairy produce?—I certainly do not think that milk should be coloured, even with a harmless colouring matter.

4962. Why not?—It is simply done for the purpose of inducing the consumer to believe that he is getting a better article than he really is getting.

4963. Do you think they should be used in butter?—I do not believe in using them in butter.

4964. Do you think they should be used in cheese?—No; of course, certain forms of cheese—for instance, Leicestershire cheese — depend very largely upon the amount of annatto, as colouring matter, that is used in them.

4965. And the same in Wiltshire, is it not?—In Wiltshire the cheeses are of a lighter colour; there they chiefly make cheddars.

4966. What about North Wilts?—In one sense they have some coloured cheese.

4967. The object of that colouring matter, I suppose, is to persuade the purchaser that he has been getting a very rich article?—Yes, but it has been carried a long way past that stage.

4968. Would you prohibit it in milk and cream?—Yes.

4969. And in butter?—I should say prohibit it in butter. I should go farther; I do not know that your Committee is dealing with the question of margarine, but I should prohibit it in margarine; and if you do not prohibit it in margarine, then insist upon a high colour for margarine, so that one can distinguish between margarine and butter. I am rather surprised that it has not been brought forward before, and that a special tint, a higher tint, than that usual to butter was not introduced before. One can very easily arrive at that point with a tintometer.

4970. It would be simpler to tint it blue or green, would it not—it would be more distinctive?—Yes. We could have it with a very high yellow, a much higher yellow than ordinary butter, if it was necessary that margarine should be tinted yellow. That would prevent an immense amount of fraud; there is no doubt about that. If it is found by evidence that milk does not keep, and there is a difficulty in delivering milk in the larger towns of England, I claim that the way out of the difficulty is that the railway companies should be pressed to find a better method of delivering their milk, that more care should be taken in the methods adopted by railway companies——

4971. By a system of refrigeration?—Possibly so, or insulation. Even insulation alone would be sufficient in summer time. We find milk carried in railway vans with latticed sides, and, as some of our railway tracks are notoriously dusty, it is quite possible for a large amount of dust to get into the cans, and it does get into the cans undoubtedly. Of course, you are aware that at the present day the lavatory carriages are very largely in use by the railway companies, and the ejecta drop upon the railway tracks. It dries up, and two trains passing together raise an enormous amount of dust. You observe that, of course, travelling by rail.

4972. But that is almost a negligeable quantity, is it not?—I do not think so. It may possibly account for some of the outbreaks that there has been a difficulty in accounting for.

4973. It could not get into the milk?—It gets to the top of the churns. With respect to other articles of food, as I mention in my proof, recently three samples of sausages were sent for analysis to our County Analyst, and these samples were returned by him as containing

Mr. J. Tubb-Thomas.

18 Jan. 1900

0·6, 0·7, and 0·8 per cent. of boric acid; that is, nearly 60 grains to the lb. Those samples were taken in the middle and latter end of November. If that quantity is used by the manufacturer in November, how much would be used in the summer time? In addition to that, of course colouring matter was used; whether the colouring matter is of a harmless character I am not sure; I know rose pink is one of the products used.

4974. Where were these sausages taken?—Those sausages were taken in the town of Trowbridge. The County Analyst, in reporting on them in his quarterly report, says:—"A more grave matter, forming part of a large general question, was the presence of boracic preservative in the sausages, in the proportions of 0·6, 0·8, and 0·7 per cent. respectively. These quantities correspond pretty nearly with those which are openly acknowledged and recommended in the pork trade for the preservation of sausages." Of course, the County Council were unable, until the result of your deliberations was made public, to institute a prosecution in that case; but undoubtedly a much larger percentage of preservative was used there than was necessary, or certainly than was desirable.

4975. Have you any experience of the other preservatives in use?—Yes, of formalin.

4976. Is that much used by dairy people?—It is getting more used.

4977. Do you approve of it?—No, I do not approve of the use of any preservative, because I say it is unnecessary, and I cannot approve of anything that is unnecessary.

4978. In your proof you have given us some of your experience as to the effects of one?—Yes. I have not had such an extensive experience with regard to formalin, but my own opinion is that formalin certainly will be injurious if taken continuously.

4979. Is any of the milk used in Newport pasteurised?—I am not living in Newport now; I am living in Wiltshire, at Trowbridge.

4980. I suppose in that county they do not pasteurise?—Some of the dairy companies are turning out pasteurised milk, but they are sending it to London chiefly.

4981. What is the population of Trowbridge?—Of course my duties carry me over the whole county. I am simply living at Trowbridge, where the population is about 11,000 to 12,000.

4982. You say there is a trade springing up for supplying pasteurised milk?—Yes; more especially is there in the town of Leciester, where I was living before.

4983. Where does the pasteurisation go on?—It goes on in the dairies.

4984. In the country?—Yes, in the smaller dairies; it is not extensive at present—it certainly can be made much more so.

4985. Is it bottled after pasteurisation?—It is bottled. I had a good deal of experience with the pasteurising of milk in Leicester.

4986. Was it carried on there?—It was carried on there by the Leicester Dairy Company very extensively.

4987. How did it compare in price with the ordinary milk?—The Leicester Dairy Company at the time I lived in Leicestershire was selling pasteurised milk at exactly the same price as it sold fresh milk, delivering it a dozen quarts at a time at a price of less than 4d. per quart.

4988. What temperature did they raise it to?—It varied according to the time of the year. To start with, the temperature was a little bit too high, and they were doing it with a little bit too much caramel, and then, of course, the milk was unsightly in appearance, and it had a burnt flavour; but after that they reduced the temperature with very satisfactory results. I never had any exact figures of the temperature they were working at.

4989. (*Dr. Bulstrode.*) With regard to this pamphlet upon boron food preservatives and their influence on the human organism, which is stated as being a collection of medical and scientific data on the subject, have you any reason to suppose that this is other than a collection of certain literature upon the subject?—It is collected for a special purpose. It is collected with one object.

4990. Do you think its more correct title would be a collection of certain medical and scientific data on the subject?—Yes, most decidedly so.

4991. You would not go further than that—that the editors, say, have selected such literature as they consider supports the view which they wish to put forward?—That is what I do say.

4992. You would not wish to say more?—I should like to say that, and to say that it is certainly edited with the object and intention of influencing persons in favour of the use of boric compounds.

4993. Now, with regard to the experimental work in it, are you able to offer the Committee any criticism as to its value? Take Professor Chittenden's work, and the results which he has obtained with dogs?—I think that the result on dogs would be of very little value compared with the results on human beings.

4994. Why?—Their method of digestion is completely different, and apart from that, considering the quantity of milk that dogs can take, I certainly think it is of very little value.

4995. You have no doubt as to the *boná fide* nature of Dr. Chittenden?—I have no doubt as to the *boná fide* nature of Dr. Chittenden.

4996. But you doubt the validity of the deductions?—Most decidedly so. I think that ehe experiments by Dr. Annett with kittens are of considerably more value, because the kitten comes, at the ages Dr. Annett has taken, very much nearer to the condition of infants.

4997. Have you studied Dr. Annett's experiments?—I have, and I have also read the reply that Dr. Liebreich sends to them; and I certainly think Dr. Liebreich does not answer them in any sense of the word.

4998. Do you know exactly how much boric acid was administered to the kittens which were being treated by Dr. Annett?—I read Dr. Annett's report; it is a varied amount.

4999. It is a little bit difficult to ascertain quite how much they were taking, is it not?—There is a little difficulty. I have his article in the *Lancet* with me, and it is certainly a little vague.

5000. Suppose you were asked as a scientific man to come to a conclusion upon the experimental evidence which is at present before us—I mean before the world generally—what would be your decision—from the experimental evidence, mind, nothing else?—I should be very sorry to come to an opinion one way or the other upon experimental evidence alone.

5001. With regard to these children that you were treating with boric acid for diarrhœa, and whose diarrhœa became worse, were there very many children so treated?—A number of children. I have been trying to hunt for my notes, but I cannot find the notes of my cases.

5002. Were they confined to one district in the town?—Yes.

5003. Were there many attacks in the same house?—No.

5004. Not?—Only the children who were taking the milk were attacked; they were the young children. It was the youngest child in the house, as a rule, that was taking the milk.

5005. Did you ascertain that the children who were attacked had been obtaining their milk supply from the same source?—Yes; and the other children in the house who were not attacked were children who were not living upon milk.

5006. Did you also ascertain the distribution of the milk supply?—Yes. Following the distribution of this milk supply, that is, following the round, I found there was the same incidence of diarrhœa amongst very young children.

5007. You found there was a special incidence of diarrhœa upon the young children supplied with milk from a certain dairy?—From certain dairies—as far as my practice was concerned, which covered the larger portion of that part of the town.

5008. Were you able to supply evidence, or to satisfy yourself, that houses which were not supplied from that dairy, but which contained young children, did not so suffer?—Yes, I was.

5009. Have you considered the question as to whether a high infantile diarrhœa rate may possibly be kept up or influenced in some way by preservatives?—Yes.

5010. Have you any evidence to put before the Committee on that point?—I cannot give any direct evidence upon the matter other than the deductions I have made in my visits as medical officer of health and also as a general practitioner.

5011. As I understand, you think that if the medical profession were made aware of the substances which are used as preservatives, and the extent to which they are used, they would be on the look-out for mischief, where at present they are unaware of a possible cause of mischief?—That is exactly the position I take.

5012. Do you think possibly that the discovery of lead poisoning and of ergotism is to some extent parallel?—Just so.

5013. That when these possible causes of harm were brought to the knowledge of the profession or of the public then the extent of the harm became more widely known?—Yes.

5014. May we take it that you yourself are idiosyncratic towards boric acid?—I certainly am idiosyncratic to it.

5015. You think you are idiosyncratic to it?—I am.

5016. How far do you think that the Legislature should concern itself with idiosyncratic people?—I do not consider that it should do so altogether, but still there is a certain percentage of those persons. My contention is this, that persons in weak health and young children are all idiosyncratic to the use of boric acid and the use of preservatives, or rather the majority of them.

5017. Would you think that idiosyncrasy—call it idiosyncrasy for the sake of argument—would be sufficiently protected by the public being informed what was in their milk?—No.

5018. Why?—Because we should not be able to give them the whole of the evidence in the matter; we should simply be able to tell them it was unsuitable or injurious to them, and then they would be able to get evidence from interested persons on the other side that may possibly lead them astray. The general public of England are not always willing to accept the truth as being the proper and correct thing.

5019. Would it not rather imply a knowledge on the part of the public as to what was and what was not good for them?—It would require them to have a certain amount of knowledge, I admit.

5020. It would be almost necessary that each person should be a medical man?—Almost, to be able properly to appreciate it.

5021. Do you think that the proportion of 85 per cent. of milk as being consumed by invalids and quite young children would be fair for other large towns than Newport?—I do so. You may take a very large number of the houses in England of the working classes, and, although they buy a halfpennyworth or a pennyworth of milk a day, you will find there is not a drop of it used except for the young child.

5022. (*Chairman.*) That would not apply in the North, would it—are you acquainted with the North?—Not much further north than Leicester. I lived at Leicester, and I know boric compounds are largely used in Leicester.

5023. Then that observation applies chiefly to the Midland and Southern counties?—Yes.

5024. (*Dr. Bulstrode.*) You say in your proof—"Boracic compounds hasten the emaciation in cases of tuberculosis, and to my certain knowledge have, in many cases, induced diarrhœa of a most intractable character in such persons"; could you give to the Committee your evidence as to the boric acid being the cause of this intractable diarrhœa?—In cases of phthisis, of course, one largely uses milk as a diet, and it came to my knowledge that patients who were using milk were obliged to give up the use of milk because of the diarrhœa that it induced after taking it. When I came to examine into the matter I found that this milk was milk that had been doctored with boric compounds. Stop the boric compounds, stop that milk, give them milk from a pure source that has not been treated in any way, and they are able to take it freely without inducing diarrhœa.

5025. Have you had experience in that detailed fashion to a sufficient extent to justify you in coming to this conclusion?—Certainly.

5026. I rather gather that you advocate practices which, on the whole, would be more likely to keep out bacteria—of course, one cannot absolutely keep them out—rather than to allow of practices which might inhibit, perhaps, only for a time the bacteria in the milk?—Yes.

5027. And that you think that the introduction of preservatives would be a retrogressive measure from the point of view of public health?—Yes, most decidedly so. I am positive of this from my direct experience in Leicestershire alone, and in other counties, that without preservatives milk cannot be sent from certain farms.

Mr. J. Tubb-Thomas.

18 Jan. 1900.

5028. That it cannot be sent from certain farms?—Yes; I have a particular case in my mind—I cannot mention the name of the farm or the name of the parish, but it is the case of a milk which has been sent into Birmingham. You will remember that some time ago the Birmingham Corporation made a raid against the use of preservatives, and in that case the man was absolutely unable to send his milk to Birmingham.

5029. How far was the farm from Birmingham?—Less than 40 miles; I forget how many miles it is from Nuneaton—it would be under 40 miles from Birmingham, say 35 miles, and the morning's milk could be easily delivered in Birmingham for evening delivery and the evening's milk for the morning delivery—no question about it. At the same time near that man there were men sending their milk to London without the use of preservatives.

5030. Did you enquire, to discover, if possible, what was the cause?—Yes.

5031. Can you tell the Committee?—Filth.

5032. Filth?—And a bad water supply.

5033. You, of course, are a County Medical Officer of Health of a very extensive district—Wiltshire?—Yes.

5034. From Wiltshire is much milk sent to London?—Very much; I believe there are two special trains a day going from Trowbridge alone.

5035. Of course, you are aware from examining the Local District Officer's Reports whether the Dairies, Cowsheds, and Milk Shops Order—Order, not Regulation—has been carried out?—It has not been carried out in the past. We are putting a lot of pressure on them now; they are now adopting regulations, and the Order will be carried out.

5036. Would you say, as a general rule, in the rural districts of England the Dairies, Cowsheds, and Milk Shops Order is not carried out?—I should say so, and I have sufficient evidence to justify me in saying that.

5037. It really is illegal, is it not, under the Dairies, Cowsheds, and Milk Shops Order to keep a cowshed or dairy without a proper water supply?—Yes.

5038. Therefore, if the law was put into force all these places not supplied with a proper water supply would have to be supplied with water, and would be able then to cool their milk?—Yes.

5039. Do you think that if the cows' udders were washed before milking, and the milker's hands were washed, and the milk was strained and cooled——And the vessels properly sterilised and cleaned——

5040. That there would be any difficulty in supplying our large towns without preservatives?—Not the slightest difficulty; there is sufficient evidence proving all that by men who for years have been sending milk to London without preservatives, and doing it regularly through the hottest weather, without any difficulty.

5041. You say in your synopsis, and you put it in large type, that "milk will under all circumstances in our climate keep for a period of 48 hours"?—Yes, I say that.

5042. Forty-eight hours?—Yes; that is, of course, supposing that all the original things necessary are provided—that is, that the teats are washed, and so on.

5043. Would you not prefer to say that milk will, "under certain circumstances," instead of "under all circumstances"?—I mean all circumstances of temperature and climate.

5044. (*Chairman.*) Under proper management?—Under proper management.

5045. (*Dr. Bulstrode.*) You think that alterations as regards railway provision could easily be brought about, I gather?—I think so. If it pays to bring meat by refrigeration 13,000 miles from Australia, surely for a distance of 150 or 200 miles you could bring milk to London and to all our large towns.

5046. (*Dr. Tunnicliffe.*) I understand that you were engaged in private practice?—Yes, in addition to being Medical Officer of Health.

5047. May I ask how long you have been Medical Officer of Health in all?—I have been Assistant Medical Officer of Health and otherwise for over twenty years.

Mr. J. Tubb-Thomas.

18 Jan. 1900.

5048. So you were not engaged in private practice before you were Deputy Medical Officer of Health?—My earliest experience was as Assistant Medical Officer of Health in a very large district.

5049. May I ask what originally drew your attention to this subject?—The question of diarrhœa with these young children, and the getting at the possible cause of this diarrhœa.

5050. Were these cases of diarrhœa in the summer that you noticed the same class of case that you quote in your synopsis?—They were the same class all through; they were not all in the summer—some were in the spring, some in the summer, and some in the autumn months, and some of the cases later in the year than that.

5051. What length of time did these observations of yours extend over?—Ten or twelve months—more, perhaps.

5052. Have you seen a similar series of cases since?—Yes.

5053. Those cases are not incorporated in this report of yours?—They are not.

5054. But you have had other similar experience?—I have had other similar experience, more especially in investigating diarrhœa as Medical Officer of Health.

5055. And you explain the fact that this is rather an exceptional experience by assuming ignorance or want of observation on the part of your colleagues?—I do not use the word ignorance; there is a want of knowledge on their part.

5056. That is a more æsthetic way of putting it. I suppose you are aware of the fact that boracic acid, salicylic acid, and even formic aldehyde are prescribed for various forms of diarrhœa and also for indigestion?—I have prescribed it myself.

5056.* For diarrhœa and certain forms of indigestion?—Yes.

5057. (*Chairman.*) Your attention was first directed to it how?—In cases of diarrhœa and convulsions.

5058. (*Dr. Tunnicliffe.*) You have prescribed them for those ailments with benefit?—I have not prescribed them since that time, because I found that carrying it on for any length of time it produces the very thing we wish to avoid, and not being a homœopath practising on the principle of *similia similibus curantur*, I certainly do not use them now.

5059. You are aware that they have been used?—Yes.

5060. With benefit?—I am aware in very many cases they have been, and in those cases I should say the physician was able to control absolutely the quantity of the preservative, that is, that he was giving the preservative in the form of medicine, and at the same time there was not a very large percentage of physic being used in the food.

5061. I was going to ask you that question—you attribute your want of success in that direction to the fact that you had no control over your doses?—Just so.

5062. (*Chairman.*) The dose of boracic acid in the new edition of the Pharmacopœia is not the same?—It is reduced to from 5 to 15 grains; it was 10 to 30 grains, so it was reduced 50 per cent.

5063. (*Dr. Tunnicliffe.*) You regard this subject, that is, the question of the possible injury to health, as being from the experimental standpoint, still *sub judice*?—Yes. In addition I should go further, and say that all the experiments have perhaps not been carried out with a sufficiently open mind. You will quite agree with me that it is possible for a man to start on a series of experiments intending to get a certain result and he will get it. It depends entirely upon the point of view of the observer—whether the observer is sufficiently disinterested in his observations when he starts on that line. I have had some little experience of laboratory methods.

5064. Do you mean seriously to make that allegation with regard to experimental work upon this subject?—No, not upon this subject, but upon experimental subjects generally.

5065. Including this subject?—Including this subject. If a man starts with a brief he will possibly get very different results than if he started when he had not got a brief.

5066. (*Chairman.*) There is the difference between science and empiricism?—Yes, and I am sorry to say that in the present day there are a very large number of men who have accepted briefs for different things.

5067. (*Dr. Tunnicliffe.*) I take it that you think the subject from an experimental standpoint is *sub judice*, your opinions are entirely culled from clinical experience?—Yes, and to a certain extent from laboratory experience as well, but chiefly from clinical experience. I think one grain of clinical experience is worth one-hundredweight of laboratory experiments upon the lower animals.

5068. You do not think experiments upon the lower animals give results of very much value in this direction?—No, I do not. It is very possible that if experiments with monkeys were carried out with proper climatic surroundings and all that sort of thing, they might be of some use, but I certainly do not think they are of very much use when carried out with cats and dogs, and in test tubes.

5069. You do not think really that any series of experiments on the lower animals, however carefully carried out, would satisfy you individually?—Certainly they would not.

Prof. W. H. Corfield.

Professor WILLIAM HENRY CORFIELD, called; and Examined.

5070. (*Chairman.*) You are an M.A. and Doctor of Medicine of the University of Oxford, a Fellow of the Royal College of Physicians, London, Professor of Hygiene and Public Health at University College, London, Medical Officer of Health, and formerly Public Analyst for St. George, Hanover Square, and Consulting Sanitary Adviser to H.M. Office of Works?—Yes.

5071. It is well known that you have given some attention to the nature and the effects of modern preservatives used in food; could you give us the conclusions at which you have arrived; first, I should ask are there any of these preservatives to which you have directed more attention than another?—Yes, salicylic acid and boracic acid I have given most attention to. My attention has been called to it from the fact that I was formerly Public Analyst of St. George, Hanover Square, and that since that time, after resigning that appointment, a good many years ago now, I have been expected by the Sanitary Authority to give evidence in support of the Public Analyst in prosecutions in cases of adulteration; and so I have devoted a certain amount of attention to it, and worked the subject up, as you may say, to a certain extent. I cannot say that I have made any practical experiments, the results of which would be of any use to the Committee. I think I had better say that at once. I have paid particular attention more recently to the effects of salicylic acid and boracic acid, as I said just now.

5072. What substances have you chiefly found salicylic acid in?—In wines, the lighter kinds of wines, British wines, for instance; there were some prosecutions some time ago for salicylic acid. I know that it is used in light beers too for preserving them.

5073. Have you any experience of the effects of salicylic acid?—I have experience of the external effects of salicylic acid. Salicylic acid is a slightly acrid substance, a slightly irritating substance, which is used externally for the removal of corns and warts. I have had a certain amount of practical experience in that way with it, and I know it does that. I have had very little practical experience of the results of the internal administration of salicylic acid, but I have studied the effects of it as they have been observed and published by others.

5074. As a physician do you object to its consumption?—Yes, I think it is a most undesirable substance to be put into articles of food.

5075. Do you think that people ought to know when they are swallowing it?—I do certainly. I think this, that with regard to both of these substances, even if it were shown, as some of them have thought they have shown, that boracic acid is perfectly harmless, and that it could be taken in considerable quantities without harm—which I do not believe is the fact—that even if that were shown I think it is extremely undesirable that such a substance should be used for articles of food, such as milk, which have to be consumed by infants and young children; and that even if you set a limit to the amount

Book Therapeutic)
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Tunnicliffes Evidence

that you would propose to allow to be used, it is impossible to say that that limit will not be overstepped by two or three persons, possibly as many as three persons, as there are instances where the drug has been added by one after another.

5076. Suppose a person were taking a small fixed quantity of salicylic acid day by day, is it certain he could get rid of the whole of that quantity in each day?—I do not think it is.

5077. Might there be a tendency to accumulation?—Yes, I think there is evidence that there is a tendency to accumulation with that drug.

5078. In that case the effects of the drug would be more severe?—Yes, no doubt. On the other hand, this must be borne in mind, that possibly with that, as with many other drugs, persons may get accustomed to their use by experimenting on themselves for a time. For instance, we know that arsenious acid may be taken, and may be taken in continually increasing quantities, without producing any apparently ill effects on the person who takes it; but that is no reason why we should allow it to be put into milk as a preservative.

5079. The same may be said of alcohol, may it not?—Yes, quite so.

5080. I believe the system cannot void more than a certain proportion of boracic acid within 24 hours, can it?—I believe that is so, but I cannot, from my own knowledge by experiment, say that it is so.

5081. It would be undesirable that anyone should consume more than he could get rid of?—Clearly, because it is obvious that boracic acid is not a food.

5082. Do you think it possible, under the existing circumstances, that any individual might be exposed to that risk of an overdose?—Yes, I think so; I think they have been many times.

5083. What do you advocate; would you say prohibition, or the necessity for declaration?—I should advocate prohibition, unless it can be absolutely and clearly shown that the drug is perfectly harmless in any quantity that is possibly added.

5084. Would you extend that prohibition to all articles of food, or to milk only?—I should say, offhand, that I should extend it to all articles of food, but really I have hardly considered that point.

5085. Of course, the use of preservatives has been recognised and legitimised in the case of salt and saltpetre?—Salt is a food, and that is a different thing; salt is therefore on a different level from all these other things, because it is a food—it is a part of the human body, it is part of every tissue, and a certain amount of salt is absolutely necessary to the existence of an animal.

5086. But there are other substances used which are not foods, such as pyroligneous acid and saltpetre?—Yes.

5087. Would you include those?—I should be inclined to include them if it cannot be shown that they are perfectly harmless, because they may be given, not merely in repeated doses, but in two or three times the quantity intended.

5088. Do you think prohibition might have a serious effect on the food supply of large towns—the milk supply, for example?—I think methods would be devised, and would easily be devised, for properly bringing the milk in the quantities in which it is brought now—I allude to methods of refrigeration, and so on.

5089. Have you any personal acquaintance with the conditions under which the milk supply is conducted?—Very little.

5090. Is there anything that you think you could tell us to assist us in our inquiry; I do not want to put too many questions to you, but is there any general or specific statement you would like to make?—There are one or two things I might say about boracic acid, for instance. The medicinal dose of it has been altered in the last issue of the Pharmacopœia. Formerly the dose was from 5 to 30 grains, the maximum dose being 30 grains, but in the last issue of the Pharmacopœia it was altered to from 5 to 15 grains, the maximum dose being reduced to 15 grains.

5091. I suppose the Pharmacopœia reflects the present body of medical opinion?—No doubt, certainly. Boracic acid is very largely used externally now, and it was formerly used internally, chiefly for the treatment of nervous diseases and more especially epilepsy; but it was given up in the treatment of epilepsy owing to the gastro-intestinal disturbances produced by it. That is an historic fact. Now it is very little used internally. I have inquired from one or two well-known chemists, one of whom informed me the other day that at any rate during the last ten years, his firm had made up prescriptions containing boracic acid very rarely indeed for internal use, and those that had been made up had been for only two or three persons—the same persons. There are a certain few persons, chiefly surgeons, who use boracic acid internally. I cannot say what for exactly, but they may be regarded as exceptions. Boracic acid, from the evidence that I have got in that way, is clearly used very little internally as a drug—much less than it used to be.

Prof. W. H. Corfield.

18 Jan. 1900.

5092. Apparently people get it elsewhere, without the prescription?—Yes.

5093. (*Dr. Bulstrode.*) You say on the first page of your synopsis that if the preservatives are used in sufficient quantity to produce their antiseptic effect on the food they must of necessity interfere with the digestive process; would you kindly amplify that a little for the benefit of the Committee?—If they are used in sufficient quantity to produce their antiseptic effect on the food, that is to say, to prevent the change of the food from one form to another they must to a certain extent interfere with the digestive change of the food, although the actions are not exactly the same.

5094. Would you say that the experimental evidence which has been obtained with regard to the action of the gastric juices, and with regard to the results of observations, *quâ* nutrition, quite bear that out; you are familiar no doubt with Professor Chittenden's observations and experiments?—Yes.

5095. And with those of Dr. Foulerton and Dr. Rideal, and with those of Dr. Annett, Dr. Liebreich, and some others?—I am familiar with some of them, and I know Oscar Liebreich's.

5096. Would you say that the results altogether bear out that general expectation?—No, I do not know that they do altogether.

5097. You are probably quite familiar with the conditions which obtain throughout Europe in reference to the dealing with preservatives?—I am not familiar with them; I know something about them; I have heard about them.

5098. You have heard, for instance, that in Austria salicylic acid is forbidden, as also are borax, boracic acid, and soda as preservatives?—Yes.

5099. Could you tell the Committee whether that prohibition has been arrived at as the result of experiment or only upon what we may perhaps call the evidence of expectation—do you know why?—No, I do not know, and I cannot tell the Committee.

5100. Similarly with regard to Belgium, in Belgium the colouring matters have been arranged in a schedule as to those which are harmless and those which are harmful; could you tell the Committee whether that schedule has been drawn up upon a basis of experiment or whether, again, upon the expectation of what might accrue from the use of metals and so forth, which are known in certain doses to be poisonous?—No, I cannot tell you the reason of it.

5101. We have been told by certain people that in certain conditions such as nephritis both boracic acid and salicylic acid are contra-indicated. I see that Dr. Bond, of Westminster Hospital, in a communication which is printed in a pamphlet on Boron states that he has given a large amount of boracic acid, and only in certain cases has he had bad results. He says: "I can only remember three or four cases where I have had to stop its administration in consequence of skin irritation and eruption, as in those cases the disease of the bladder was complicated with Bright's disease of the kidneys, which no doubt, interfered with the elimination of the acid by the kidneys." With regard to salicylic acid, I would just like to read you a paragraph from Dr. Mitchell Bruce: "Sometimes, however, the salicyl compounds so irritate the kidney as to cause albuminuria, and even hæmaturia; and they must be used with great caution when given for these or other purposes, if renal or hepatic disease be present, and in aged persons, inasmuch as under their influence there is an increase in the amount of uric acid waste, and they are apparently not diuretic. Salicylates are believed by some authorities to be harmful in gout." Now, if that is true, would there or would there not be a large number of people upon whom the exhibition of these preservatives is contra-indicated?—A very large number of people, I should say.

Prof. W. H. Corfield.

18 Jan. 1900.

5102. Could you give the Committee any idea of the number of deaths there were, say, in 1897, from renal disease?—I am afraid I could not.

5103. If I tell you there were nearly 12,000 deaths, what extent of illness as regards diseased kidneys in that same year would you think that represented?—Ten times or twenty times as many, probably more than that.

5104. So there would be a very large number of people having uric disease upon whom these drugs in certain quantities were contra-indicated?—Yes, no doubt.

5105. Would you think that a strong argument against their indiscriminate use?—Yes, I do, certainly.

5106. There is one more point I should like to ask your opinion upon without, of course, in any way binding myself or anybody to the statement. This is with regard to the use of borax, and I will read you from Sir Lauder Brunton's book: "Borax has been supposed to have a special action upon the uterus, and has been employed in amenorrhœa, dysmenorrhœa, puerperal fever, and convulsions. On account of its asserted power to increase the uterine contraction it ought either to be avoided or employed with care during pregnancy." If that is true do you see there a somewhat serious objection to the indiscriminate use of borax?—Yes.

5107. Could you tell the Committee how many births there were in 1897 in England?—No, I cannot remember that.

5108. There were between 900,000 and 1,000,000; would you say that represented a serious danger if this statement of Sir Lauder Brunton is true?—Yes. I should say it did.

5109. In your synopsis you quote from the "Journal" of the Academy of France as to the conclusion which they came to in reference to salicylic acid: would you mind telling me whether the passage I have marked there is the one which you quote in your proof; I could not quite find it before lunch when I was looking for it (*handing the Journal to the witness*)?—That is evidently the sentence; I have quoted a translation of it from somebody else.

5110. I think probably you would rather have the original?—Yes, much.

5111. Would you please translate the passage, as it is before you, because I do not think the passage in your synopsis quite conveys the meaning?—Yes. "It has been established by medical observation that feeble daily doses of salicylic acid or of its derivatives taken for a prolonged period, are capable of determining marked disturbances of health in certain persons susceptible to the action of this drug, in aged persons, and in those who have no longer a perfectly sound condition of the renal apparatus or the digestive functions."

5112. That is not quite the same as the passage in the synopsis; I think there is not much difference, but there is a little?—Yes, there is a little. It is evident that I have quoted it from some translation. I have not seen the original before.

5113. Do you think, as a Professor of Public Health, that the use of preservatives would be a measure calculated to lead to cleanliness, and general measures of precaution against infection and dirt in milk?—Do I think that the use of preservatives is likely to tend to cleanliness?—No, I should say certainly not, I should think the other way.

5114. You think that methods of proper cleanliness should be adopted?—Yes, certainly I do, and I would encourage the carrying out of the Dairies, Cow Sheds, and Milk Shops Order.

5115. Do you attach much importance to the experiments performed on animals?—Not very much.

5116. Suppose a series of experiments on young animals is carried out by reliable persons, say on some young kittens or some young monkeys, or young animals, whatever you are inclined to take, and certain definite results are obtained of one or another kind, do you consider that those results should govern the decision of this matter?—No, I do not, certainly.

5117. Upon what ground do you think a question of this sort should be decided?—I do not think arguments from such a source would apply to the giving of drugs to young children in their food.

5118. You do not think it is safe to argue as to the results of drugs upon one species to what would be the results upon another?—No, the results are very different very often.

5119. Would you prefer to go upon evidence as regards the human species, and upon what might be expected upon general principles to be the result?—I beg pardon?

5120. Say you are called upon to decide this question as to whether preservatives are harmful; you say you would attach little or no importance to the result of experiments upon animals?—Yes, very little importance.

5121. Then to what would you attach the greatest importance in the consideration and summing up of the question?—To the known action of these drugs upon human beings, especially upon young children.

5122. Suppose there were not much real evidence as to what the action was upon invalids and young children, what then would be your position?—Then I should avoid them as much as possible if there was not much real evidence.

5123. Now, why would you avoid them?—Because they are not foods.

5124. Suppose they served a useful purpose?—If there was no evidence I should assume that a drug was probably harmful.

5125. Harmful?—Yes, if you have little or no evidence.

5126. (*Dr. Tunnicliffe.*) I think perhaps this question will clear this matter up better; would you regard it as incumbent upon the advocate of preservatives to prove their harmlessness?—I should certainly.

5127. That is what you would wish to say?—Yes, that is exactly my view.

5128. Have you yourself had a suspicion that a preservative in food was connected with any epidemic of diarrhœa with which you have had to do in any way?—No, I do not think so. You mean in my own personal experience?

5129. Yes, or in your professional capacity?—No, I cannot say that I remember anything of the kind.

5130. I take it that an epidemic of diarrhœa would come under your notice in your district?—Yes, an epidemic of diarrhœa would.

5131. You have never had a suspicion that such an epidemic of diarrhœa was caused by any chemical preservative in the milk supply?—No. I do not remember any epidemic of diarrhœa, except what we call ordinary summer diarrhœa, which we do not pay much attention to; the medical practitioner pays attention to it, but unless it was anything very severe the Medical Officer of Health would pay no attention to it at all.

5132. It would not come under your notice?—No.

5133. Have you any views with regard to the colouring of substances artificially?—I have no strong view about it, but I have not thought about that matter very much.

5134. You have not thought, for instance, about the presence of copper in preserved vegetables?—It has not been under my notice for a great many years. When I was a public analyst I remember having some cases of copper in preserved vegetables, but it was a great many years ago, and I have really paid no attention to that particular point since; I do not think I could tell you anything that would be of any real use here.

5135. I take it from what you have said that you regard the use of preservatives in milk as standing on a different level to the use of preservatives in other foods?—Yes, on a somewhat different level, because milk is such an important food for infants and young children generally.

5136. You would not see the same objection to the addition of preservatives to butter, for instance, that you would to their addition to milk?—The objection is the same, only it is not quite so strong; that is the view I should hold.

5137. It would not be likely to do so much harm?—No, it would not.

5138. With regard to the conversation which you had with a chemist, you were told, I believe, that certain people, a few people—doctors, that is to say—used boracic acid habitually, and others did not use it at all—that is what it amounts to, is it not?—Yes.

5139. That would rather in your opinion, would it not, tend to show that the use of boracic acid, at any rate, so far as it was used, was not attended with any very evil consequences?—These persons who use it believe that it does good in certain cases.

5140. And they continue to use it?—Yes, some do undoubtedly.

5141. Therefore to some extent one would think that

that would show, as far as the use in question was concerned, no injurious effects had accrued?—Boracic acid is a drug.

5142. I mean as a drug?—And it is suitable for certain purposes, and for these purposes the persons who prescribe it consider that it does good—whether it does or not, I do not know.

Prof. W. H. Corfield.

18 Jan. 1900.

5143. They continue to prescribe it, at any rate?—Some persons do, but evidently very few people from the evidence I have got.

5144. But those who continue to prescribe it apparently would not do so if they got other effects than those they wished for—that is to say, indigestion and so forth?—No, I presume they would not.

EIGHTEENTH DAY.

Friday, 19*th January*, 1900

PRESENT:

The Right Hon. Sir Herbert Maxwell, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. Thorpe F.R.S.
H. Timbrell Bulstrode, Esq., M.D.
F. W. Tunnicliffe, Esq., M.D.
Charles J. Huddart, Esq., *Secretary*.

Mr. Walter Collingwood Williams, called; and Examined.

Mr. W. C. Williams.

19 Jan. 1900

5145. (*Chairman.*) You are a Fellow of the Institute of Chemistry, I think?—I am.

5146. Public Analyst for the Boroughs of Blackpool, Blackburn, and Barrow-in-Furness, and Assistant Analyst for the County of Lancaster, the City of Liverpool, and the Borough of Bootle?—That is right. I am also a Bachelor of Science of London University.

5147. You have been engaged in some observations on the presence of preservatives in the modern sense in various articles of food, I believe?—Yes; we have among other things devoted attention to that. We examine about 3,000 samples every year of one kind or another in our laboratory.

5148. I suppose your experience coincides with that of other witnesses, namely, that the most frequent substances are boracic compounds, formalin, and salicylic acid?—Yes.

5149. In what proportion of the samples did you find preservatives present?—That depends very much upon the nature of the sample. We found it very seldom in unadulterated new milk. Out of 964 samples of new milk we only met with borates in four cases. In skim milk and separated milk borates are very much more common; out of 294 samples we met with borates in 13.

5150. What was the area of your observation—the boroughs of Blackpool, Blackburn, and Barrow-in-Furness?—And the whole of Lancashire and the whole of Liverpool; really the greater part of my duties is in connection with Lancashire and Liverpool.

5151. (*Professor Thorpe.*) Pardon me, you cannot say the whole of Lancashire, can you?—The whole of the administrative county. I am the analyst appointed with Dr. Campbell Brown by the County Council.

5152-54. Your jurisdiction does not extend over Manchester, does it?—No, that is not part of the administrative county.

5155. (*Chairman.*) The milk supply of Liverpool, as shown by your researches, is conducted to a very large extent without the use of preservatives?—Yes, almost entirely without the use of preservatives, except in the case of separated milk and skim milk.

5156. Is there any difference in the frequency of the occurrence of preservatives according to season?—As far as borates are concerned, confining one's observations to the last year, which is the one where our records are most complete, we have met with them more in the winter than in the summer. We had three cases in January, three in February, one in March, four in April, one in May, four in June, and then none in the remaining five months until the end of December, when we had one.

5157. Are you able to give any reason for that difference?—I do not know whether there is any special reason why the use of boracic acid is so rare at certain times, but it is possible that it is better worth while to preserve milk in winter than in summer, because it is more valuable then.

5158. Do your local authorities restrict the use of preservatives in any way?—They have obtained a conviction for the use of formalin in milk, and they have endeavoured to obtain a conviction for the use of salicylic acid in certain kinds of temperance wine, but were unsuccessful. I do not think that any prosecutions have been instituted for boric acid pure and simple.

5159. Is that because of an impression that formalin is more apt to be injurious than boracic compounds?—It was really because formalin was a new thing which appeared to be greatly increasing in frequency. I suppose the prosecution was taken with a view to check it, and it certainly had that effect.

5160. Have you found that formalin is more generally used in milk than boric compounds?—The figures are—out of 1,181 samples of new milk examined ten contained formalin, and out of 1,524 samples of milk altogether only 15, so that there are rather fewer, as a percentage of the whole, with formalin than with boric acid.

5161. Then at present in Liverpool the use of formalin is illegal?—They have obtained a conviction in one case; I should not like to say we could stop it in every case; in that case there was a good deal used, and I think that had something to do with it; to a certain extent we are waiting for the decision of this Committee.

5162. Was the proportion ascertained?—The proportion is very difficult to ascertain; in fact, it cannot be ascertained with anything like precision; but it certainly was large relatively to the usual amount used.

5163. How can you tell—did it affect the flavour?—By the length of time the milk kept over and above other samples unpreserved, compared with the length of time that formalin usually keeps milk; and also the depth of colour that was obtained by the Hehner reaction gave us a clue. But we stated no definite quantity, and I should not like to attach much weight to any guess at it. There was more than usual; I am certain of that.

5164. Have you any evidence regarding the use of preservatives in cream?—Very few samples have been submitted to us to analyse. We have had altogether this last year six, three taken in the autumn and three lately. As regards those the preservative was always boric acid or a borate, and the proportion was from 17 to 38 grains in the pint. Two pairs of those samples (four of those samples altogether) were from the same purveyors, one lot taken in the autumn and the other in the winter. In one case (in the autumn) the quantity used was larger than recently—about double as much; in the other case, the quantity used in the winter was rather larger than had been used in the autumn.

5165. Owing, do you assume, to the fact that cream is more valuable in winter than in summer?—No, I do not think that in this case. These were potted creams. I think in one case that they simply add a uniform quantity all the year round, and do not think about it, whereas the other people may consider that in winter they might use less. The difference in the amounts was very trifling

Mr. W. C. Williams.

19 Jan. 1900.

in the case of the one in which the same quantity was found in both seasons, being in one case 32½ and in the other 38 grains; but the other people had reduced it by one-half.

5166. Had that cream passed through many hands?—The seal had not been broken since it left the original purveyor. It was sent out in the one case in pots, in the other case in bottles.

5167. Have you any evidence to show that preservatives are used to conceal the inferior or deteriorated quality of the cream?—One sample that we had was quite unfit for use, although apparently not sour—not curdled, that is. It had a very unpleasant fishy taste which was evidently due to the cream going stale. That was preserved by boric acid, and probably without boric acid it would have been quite unfit for use, and would not have been used by anyone.

5168. Had the preservatives in that instance been applied after the cream had begun to turn?—I do not know whether that is so or not, but I think that a sample that contains a preservative will not take the usual course of decomposition, but that it will become tainted without curdling in the way that it would without the preservative.

5169. What statistics have you about the use of preservatives in butter?—Since May to December we have examined about 200 samples, especially for boric acid and borates, which was the only preservative besides salt that we ever found in butter. Out of 222 we found that 56 samples contained it, and the quantity found was from, in one case, only two grains, up to 62 grains, calculated as boric acid.

5170. Two grains up to 62 grains per lb.?—Yes; the usual quantity is from 10 to 30 grains, where it is present.

5171. Do you know whether that was foreign butter or home butter?—I am quite unable to say that. The frequency with which samples were found to contain boric acid was greater in the summer months; it reached the maximum about September, when it was about 37 per cent. of the samples examined, and it has now fallen again to about 20 per cent. of the samples examined.

5172. Do margarine samples come before you?—Yes, a considerable number. The margarine samples that we have to examine are mostly obtained under the name of butter, and we do not have so many purchased as margarine. The total number of samples examined is 89, and out of that number nearly all of them contained borax or boric acid.

5173. I do not understand how they come into your hands as butter?—It is not at all common for an inspector under the Food and Drugs Act to go and ask for a sample of margarine for the purpose of having it analysed as margarine on its merits. The samples of margarine we get are usually sold as butter to an inspector asking for butter.

5174. That in itself is an offence, is it not?—That in itself is an offence; but, in addition to that, we have examined these samples for the presence of preservatives for some time, and we have almost invariably found borates there.

5175. Margarine is very extensively used in cooking, is it not?—Yes, I believe so. The quantity of preservative used is not usually very large—not so large as in butter, I think. About 20 grains or so is the usual amount; but, of course, it varies.

5176. Have you anything to say upon other articles?—Yes. We have examined different samples of meat, hams, and so on. Six samples of ham were examined of which four contained borax, that is, they were actually cured with borax, and contained borax in the substance of the meat. It is a common practice to dust hams over with borax on the outside; but I have not included those cases. The quantities found were 4 grains, 6½ grains, 7½ grains, and 24 grains of boric acid per pound.

5177. You say "cured" with borax?—Yes, that is, the substance of the meat was penetrated with preservative.

5178. Have you any reason to know that they were intentionally cured with borax, or did that substance find its way into the meat after mild curing?—I had this evidence on that point, that in cases where the borax has been only on the surface, we have not found that it penetrates far into the meat. We have always rejected the outer part, about, I think, a quarter to half an inch of it, and analysed what was in the centre.

5179. Do you know whether this meat was of foreign or home origin?—I knew in some cases, but I cannot say which was which; some of it was foreign.

5180. What have you to say about bacon?—We examined six samples of bacon, of which three certainly were found to contain borates within the substance of the meat, the quantity found being 2½ grains, 5 grains, and 8½ grains to the lb. Of five samples of sausages two contained borate, the quantity being 5 and 6 grains. Three samples of pork pies were examined, one contained borate, the amount being 2 grains per pound of the pie, but if calculated on the meat present in the pie, it would be 7 grains in the pound of meat. Altogether there were 20 samples of that kind, and ten with borax in. As regards jam, we have examined about 20 samples recently, and we found that 15 of them were preserved with salicylic acid. The quantity is very variable. We have found more variation since we wrote our letter to the Committee. We found as little as a quarter of a grain in strawberry jam, up to 4½ grains per lb. of salicylic acid in black currant jam. The fruit was sound in all cases except one, which was a sample of raspberry jam without preservative.

5181. What condition was that in?—There was growing fungus penetrating the fruit. The samples of preserved bottled fruits examined contained no preservatives. We examined seven of those, and did not find any preservative at all in them. Samples of damson jam and apricot jam were found to be without preservatives. In the case of the large, clean fruits, like those, it appears to be quite possible to make the jam without anything of the kind.

5182. Why do you draw that distinction?—Because such fruits as raspberries and black currants are very liable to arrive in a more or less damaged condition, and would be naturally liable to ferment more than a large, smooth-skinned fruit, like an apricot or a plum, and because, also, we have, as a rule, found more preservative used in jams made of these small fruits that cannot be cleaned or washed in any way.

5183. Has it been represented to you that it is necessary?—Proceedings have not been taken in respect of jam at all, so no representations have been made to us on the subject.

5184. You are inclined to suppose that there would be difficulty attending the manufacture of jams from small fruit if preservatives were prohibited?—Yes, I think that on a large scale it might be found to be so.

5185. Would you be inclined to modify that opinion if you were satisfied that some of the largest jam makers in this country dispense with the use of preservatives altogether?—Certainly; I should be perfectly prepared to support that if it was shown to be possible to do without it; in fact, in any case, I think 4½ grains to the lb. is far too much.

5186. I think you said you had examined temperance drinks?—Yes. I think this is a branch of the subject that has been rather overlooked. The amount of salicylic acid used in some of the temperance drinks is perfectly astounding.

5187. They are consumed in large quantities, I suppose?—I think they are consumed considerably at children's parties and such like festivities. First of all, there is lime juice and lime juice cordial. We have found that unsweetened lime juice can be made and is made without preservatives. It has been found that to enable it to keep it is only necessary to exercise careful selection of the fruit, and to use cleanliness in putting it up into bottles. Under those circumstances, the essential oil of the lemons is a quite sufficient preservative, and it does not decompose. Lime juice cordial when sweetened appears as a matter of fact to contain preservative. We have found from 20 grains up to 108 grains per gallon.

5188. I suppose that is to stop fermentation?—Yes, it is. Salicylic acid is particularly effective in that direction as regards stopping the fermentation of acid liquids.

5189. Did you find in any case a sweetened lime juice without preservatives?—I have not found it; 20 grains is the smallest quantity I have found used commercially. In another case there were 4 grains of salicylic acid and formalin also, but I am unable to say how much formalin there was. In another case there were 8 grains of salicylic acid and 74 of boric acid. As regards that, I think boric acid is not a very suitable preservative for the purpose, and I am doubtful whether it is of any use, so that if that sample could be commercially made up, it shows that a much less quantity of salicylic acid would be sufficient for the purpose.

5190. I think you say you have found some samples of unsweetened lime juice without any preservative?—Yes, but not of the sweetened lime juice cordial. A sample of lemon squash contained 50 grains of salicylic acid per gallon, four samples of ginger wine contained from 49 up to 113 grains per gallon, four samples of raspberry wine from 87 up to 133 grains per gallon, three samples of orange wine from 94 up to 106 grains per gallon, and three of black-currant wine from 47 up to 140 grains per gallon.

5191. Are these all temperance drinks?—These were all non-alcoholic temperance drinks.

5192. They are called wines?—Yes, they are.

5193. (*Professor Thorpe.*) Do you also mean that they are called non-alcoholic?—No, I mean that they really were non-alcoholic, except perhaps for the merest traces of alcohol. They were examined for alcohol in all cases. Prosecutions were instituted in some of these cases in Liverpool, but they failed.

5194. (*Chairman.*) For what reason?—It was asserted that it was necessary to use something to preserve the stuff, and various doctors appeared, who said they did not think that the quantity present would do anybody any harm, in fact it was rather a good thing if they happened to have rheumatism.

5195. That is rather a haphazard mode of prescription, is it not?—Certainly. Then, again, in other cases the defendants urged that their juices were not like other people's, that they were made from actual fruit juice, and that they needed more preservative than a mere mixture made up from citric acid and sugar. I found there was some truth in that. That was in reference to black-currant wine; but as they used quite as much, or very nearly as much, in ginger wine, which is not made from fruit juice at all, and is really nothing more than a flavoured sugar solution, I do not think the defence was very valid. From experiments I made myself with both natural fruit juices and also with sweet citric acid solutions, I found that 50 grains per gallon was quite enough to preserve a natural fruit juice such as orange juice, lemon juice, and damson juice, for an indefinite period, even when I infected the liquid with fungus spores. As regards the sugar solutions, 25 grains was amply sufficient.

5196. Does that dispose of the temperance beverages, or have you anything more to say on that point?—In connection with the same thing I made some experiments on artificial digestion with salicylic acid, and I found it had a very marked effect in retarding the digestion of hard boiled white of egg, but it had practically no effect on the digestion in alkaline media—that is the pancreatic digestion.

5197. (*Professor Thorpe.*) I should like to ask you some questions with respect to the statement that you have made that boric preservatives are more frequent in the winter months than they are in the summer. You state that of 875 samples twelve cases were observed during the months from January to May, four in June, and none in July, August, and September. Do you not think that is a very narrow basis upon which to draw so wide an inference?—Yes; I say that I am surprised to find that more cases occurred in winter than in summer.

5198. But is it not also a very narrow basis upon which even to show some surprise?—I do not see that it is; I merely state the fact as I find it.

5199. You attempt to explain it by saying that you think it may be reasonable to suppose such is the case, because there would be more desire on the part of milk vendors to preserve the milk in the winter, because it is scarce?—Yes.

5200. Therefore they would be more apt to use preservative. At what time of the year is milk most plentiful?—I suppose about the early summer.

5200*. In June?—Yes.

5201. Your figures seem to show that the June samples contained more preservative than those taken at any other time of the year?—No, they did not.

5202. You have only twelve cases inclusively from January to May, that per month is something between, at most, two and three?—It did not occur equally. Three occurred in January, three in February, one in March, and four in April.

5203. In June, however, you still have four?—Yes, I have four in June.

5204. At a time when milk was most plentiful?—Yes.

5205. Does not that dispose of the contention?—No, the contention, so far as it is worth anything, is mainly applicable to the January and February samples. I do not mean to suggest that this is the only reason for the use of preservatives, but it may be a reason for using them in winter.

Mr. W. C. Williams.

19 Jan. 1900.

5206. It is not worth very much then, because it seems that when milk is most plentiful you have as many cases of boracic acid as when it is least plentiful?—No. I do not think we do.

5207. You said so just now. The maximum number you gave in any of the inclusive months was four during what you call the winter months?—That was in new milk only.

5208. It is in these milks which we are now talking about?—Yes; but that was in new milk. If you take the total numbers there were 17 altogether.

5209. When did you observe the maximum number of cases of borax or boracic acid—in what month in the year?—In the actual months, taking them month by month, there were most in April and in June.

5210. There were most cases of borax in April and in June?—Yes.

5211. Is that the time of the year when milk is most plentiful?—I should not think so in April. In June I daresay it is so.

5212. It is about that period of the year that milk is most plentiful?—Yes.

5213. It seems to appear, therefore, that boracic acid is put in at the time of the year when milk is most plentiful?—Yes, but there were none from the end of June to October, when milk is also plentiful; but it is put in so seldom that really it is hardly worth considering.

5214. That shows that the basis of your deduction is perhaps not very sound?—Exactly; I do not think it is of very much importance.

5215. And also the deduction to be drawn from it?—The curious part of it is that preservatives should be used at all when the weather was so cold—in December and in January—when there seems to be no earthly necessity for it.

5216. I gather from your statement that you strongly deprecate the use of formalin as a preservative?—Yes.

5217. Would you kindly state why you deprecate its use?—Because it has a very powerful effect upon animal membranes and upon such substances as gelatine, and also because I have found that it renders substances less digestible.

5218. That is on purely sanitary grounds you deprecate its use?—Yes, on purely sanitary grounds. My objection is not confined to formalin. In common with other preservatives, it enables stale milk to be sold as fresh, and it enables less cleanliness to be practised in the dairy with impunity. I also object to it because it is totally unnecessary.

5219. Then those objections would equally apply to the case of boracic acid?—Yes, they would certainly.

5220. You think it would be a gain to the community on the whole, then, if the use of these preservatives was prohibited?—In milk, absolutely.

5221. Now, to come to the samples of potted cream which you told us of. Were those potted creams mainly obtained from grocers or from dairy shops?—I think all from grocers—I am not sure about one of them, but I know the other five were not obtained from dairies.

5222. You would suppose from the conditions of the trade, would you not, that boracic acid is more required by the grocer than it is by the dairyman?—Yes, certainly.

5223. You would not be surprised, therefore, if the grocers as a body should plead for the retention of these things?—No, I should not.

5224. They are required for the purposes of their trade?—I think each article that we are considering has to be dealt with on its own merits.

5225. Quite so. We will confine ourselves to dairy products for the moment. Because the grocers are trying, perhaps, to usurp the functions of the dairyman and to capture a portion of his trade, it is necessary, in order to achieve this, that they must have the use of preservatives?—Yes, partly so, I have no doubt.

5226. It is a necessary consequence of their wishing to take over a portion of a trade which legitimately belongs to dairymen, that they require the use of preservatives?—I think if the dairyman dealt in this kind of cream, he would also have to use a preservative in it in summer.

5227. We will come to that in a moment. Have you taken, or had taken, samples from the dairyman of exactly this kind of produce?—No.

5228. The dairyman, however, is a man whose custom leads him, I suppose, to do a much—what shall we call it?—quicker turn-over trade; he is in the habit of getting rid of his produce quickly, and recognises the necessity of getting rid of his produce more quickly than, we will say, the grocer?—Yes.

5229. Therefore, he is not habituated to the use of preservatives by the custom or necessity of his trade?—No.

5230. And he will not have the same predilection for the use of them?—He has been prosecuted in several instances.

5231. By trade custom he would not have the same necessity to do it—by the habits of his trade?—No, he would not.

5232. You have spoken of the use of boracic acid in articles like margarine and butter, which might be used for cooking purposes. Now, can you tell us as a chemist what would be the action of borax, we will say, upon melted butter or melted margarine?—It would not have any action upon the fat.

5233. Are you quite sure?—I think so.

5234. Borax is an extremely feeble combination as a salt, is it not —Yes.

5235. It has an alkaline reaction?—Very feeble, yes.

5236. But even although it is a bi-borate of soda, it still has an alkaline reaction?—Yes.

5237. Does not borax act chemically to some extent as if it were an alkali in many of its reactions?—Yes.

5238. What would be the effect of it acting as an alkali upon melted butter?—It would tend to saponify it if it did anything; but it would not do anything under the conditions obtaining in cookery; I think it is very doubtful if it would have any appreciable effect.

5239. You do not know whether it would have any tendency to saponify the fat?—I do not know that it would; I have never tried.

5240. I am asking you, from your chemical knowledge, do you not think it would saponify the fat?—If it were heated for a long time.

5241. Supposing we were frying fish or something of that kind in melted fat containing borax, would there be a tendency to saponify the fat?—Possibly, a small quantity.

5242. Supposing the fat were saponified and a certain amount of soap was formed by the hydrolysis of the fat, what would happen as you went on heating it; would it or would it not acquire a very disagreeable flavour?—I do not know whether it would or not.

5243. Did you ever hear that the very best qualities of butter-scotch, for example, which, I am told, is a mixture of sugar and melted butter, can only be made by the use of butter which is absolutely free from any trace of preservatives? Did you ever hear of that?—No, I never heard of that.

5244. It is a fact that you cannot make butter-scotch with a proper flavour if the butter you employ contains borax, on account of that saponifying action of the borax upon the fat and the tallowy kind of taste which the fat gets; you do not know that?—No.

5245. You may take it from me that is a fact?—But, I beg your pardon, boric acid itself would not have any action of that kind.

5246. I did not say boric acid—I exclusively kept myself from saying anything about boric acid; but no preservative, as a matter of fact, in common use is alone boric acid?—That is so.

5247. They are all mixtures, are they not, of borax and boric acid?—Yes.

5248. I am speaking exclusively of the action of borax on these things?—Of course saponification might be helped by the volatility of the boric acid.

5249. It is not volatile except in presence of water, is it?—But water is present in butter.

5250. The water will only accelerate the action; of course the alkali would remain?—Yes. This is an aspect of the case I never thought of before.

5251. You said your experience went to show that margarine very frequently, if not almost always, contained boric acid?—Very frequently, but I have found it without.

5252. I am now talking about margarine as we have it defined by the present Act, you know?—Yes, exactly, I understand you.

5253. You are speaking, no doubt, of mixtures?—Yes, I am speaking of mixtures in some cases, but I think in very few cases was there more than 25 per cent. or so of butter fat. The great majority were margarine, as now legally defined.

5254. Take margarine as it is implicitly defined by the law of to-day; margarine is a mixture which contains not more than 10 per cent. of butter fat?—Yes.

5255. Do you think in a mixture of that kind that preservatives are really required?—I doubt whether boric acid or borates are really of any service at all in butter and margarine.

5256. You think they are of no service?—I am very doubtful if they are of any real service.

5257. But of course in margarine it is of still less service than in butter?—Margarine is churned with milk, and therefore may be expected to contain a certain amount of casein, and does contain a certain amount of casein, which will be a decomposing centre, I take it. Certain samples of margarine that I have had without preservative have gone perfectly mouldy; I have seen that.

5258. Is there any necessity in the manufacture of margarine to leave the milk products in, I mean the casein and the others?—One finds them in the sample.

5259. Is there any absolute necessity in the method of manufacture to do that?—I do not know; that I could not say; I never found margarine without curd.

5260. I gather you think that margarine requires the presence of borax or boracic acid?—No, I do not express any definite opinion about margarine one way or the other, except that the trade appears to be using it in almost all cases, and therefore I suppose they have to use it.

5261. Do you really see any more necessity in the case of margarine than in the case of butter; and in the case of butter you do not seem to see much necessity?—I do not see myself so much necessity in the case of margarine.

5262. (*Chairman.*) But you assume from the greater frequency of the preservative in margarine that the trade finds it more necessary to use it?—Yes. There is one other point, and that is that margarine is usually made with less salt than butter; it may be that in order to produce a mild-flavoured article such as that, they use this preservative in the place of a certain amount of salt.

5263. (*Professor Thorpe.*) You think there is not any *a priori* reason for insisting on the use of borax?—As regards the fat I see none whatever, certainly; but as regards the curd, if it has any preservative value that is where it would be required.

5264. From the circumstance that the use of salicylic acid is rapidly decreasing in articles in which it was formerly used you incline, I gather, to believe that experience has shown no absolute necessity for its use?—I did not quite catch the drift of your question.

5265. I gather from what you have said that the number of samples of jam containing salicylic acid is decreasing?—In jam, yes; we thought so, and hoped so, but the last three months have rather dashed that.

5266. I beg your pardon; I am only talking of what I have read in your synopsis—perhaps you would wish to qualify that?—I do certainly, because since that was written I have found the maximum amount, namely, 4½ grains per lb.

5267. Then do you think it is or is not diminishing?—I do not think it is; it is only certain makers who are doing without it apparently.

5268. (*Chairman.*) That case you have just mentioned would be jam made last summer, probably?—It might or it might not be.

5269. I understood that you found the maximum amount in a sample taken during the last three months?—Yes; it probably would be this season's jam.

5270. Last summer was an unusually hot summer, was it not?—Yes.

5271. Possibly there might be a connection between the extra use of the preservatives and the extra heat?—I do not think there is any necessity on that account, because once the jam is safely covered and potted there is not much risk of further decomposition, except from germs or something contained in the original sample. It depends more upon the quality of the original fruit than upon the heat of the weather subsequently.

5272. (*Professor Thorpe.*) Then we may gather from you that, assuming due care has been taken in the selection of the fruit and in the method of boiling or otherwise preparing the jam, such a preservative as salicylic acid is not required?—Yes.

5273. And we may further gather, I suppose, from you that if salicylic acid is found it is an indication of either inferior fruit or inferior workmanship?—No, not necessarily, I think; in many cases I think it has become habitual to use so much preservative, and it is done without much thought one way or the other.

5274. Would it be any great hardship to an industry legitimately carried on to prohibit the use of salicylic acid in those cases?—I do not think it would.

5275. You think considerations of public health certainly ought to lead to the prohibition of so comparatively dangerous a drug, I may say, as salicylic acid?—Yes, certainly, I do; especially since the salicylic acid used is very often not pure and contains cresotic acid, which is very much more poisonous.

5276. That is the artificial salicylic acid?—Yes.

5277. You told us of temperance drinks in which you found relatively large quantities of salicylic acid; would you mention again shortly the temperance drinks in which they may be found?—Lime juice cordial, lemon squash, ginger wine, raspberry wine, orange wine, black currant wine, and also in ginger ale and herbal ale; I am not sure that I mentioned the last two before.

5278. No I think you did not. Are any of these things the kind of temperance drinks that might be given, we will say, to children?—Certainly, they are given to children principally.

5279. They are principally given to children?—I should think so; I do not think anybody else would care to drink them; they are very nasty in many cases.

5280. Poor children! If some benevolent persons took a school out for a treat in the country as a picnic and gave the children, we will say, something to drink, naturally they would give them, I suppose, either temperance drinks or milk?—Yes.

5281. In the one case they might give them salicylic acid, and in the other case they might give them either formalin or boracic acid?—Yes.

5282. And in considerable quantities?—Considerable quantities of salicylic acid.

5283. And, of course, in the large quantity of milk the children would naturally drink considerable quantities also of one or the other preservatives?—It might be so.

5284. (*Chairman.*) They would also probably give them a quantity of coloured sweets, would they not?—Yes.

5285. (*Professor Thorpe.*) The lime juices you have mentioned, I suppose, were lime juices preserved without the use of spirit?—Yes.

5286. In all cases?—In all cases. All these that I am speaking of are entirely non-alcoholic.

5287. Of course, you are aware that large quantities of lime juice go into consumption, especially in the Navy, which are preserved by the use of a spirit?—Yes.

5288. In your opinion all these preservatives that we are talking of are used?—Yes.

5289. (*Dr. Bulstrode.*) With what total population are you in your capacity of Analyst and Assistant Analyst officially connected?—I am afraid I cannot give you those figures, but they would be contained in the Local Government Board's Return, if that is accessible.

5290. May we take it that you are Analyst, or that you have relations from the point of view of Analyst with Blackpool, Blackburn, Barrow-in-Furness, Liverpool, Bootle, and the administrative county of Lancaster?—Yes.

5291. Roughly, what can you put that at?—I believe it is somewhere near three millions, but I am not quite sure.

5292. You think that would be about it—three millions?—Somewhere about that.

5293. Have these specimens of milk of which you have told us here been drawn more or less indiscriminately from the area occupied by this population?—About half of them have been drawn indiscriminately from the more rural part, or at any rate the county part, and about half of them—or rather more than half—from the city part; rather more than half of the total would come from Liverpool.

5294. More than half of the specimens referred to here, that is to say about 400 came from Liverpool?—Yes.

Mr. W. C. Williams.

19 Jan. 1900.

5295. May we, do you think, take your figures here as a fair indication of what takes place as regards milk in Liverpool?—Yes.

5296. Then the conclusion to which we may come is that a population of 650,000, is it?—Yes, something like that.

5297. Can be almost entirely supplied with milk without the use of preservatives?—Yes, in fact I might make that a little stronger, because in the case of Liverpool the frequency has been less than these figures show.

5298. Can you give us the figures separately for Liverpool, with its population of 650,000 or thereabouts?—I have not got any separate return for Liverpool, but I know it is less frequent. (*See Apps. Nos. 28 and 29.*)

5299. The number of specimens you found borax in was so small that we may take it generally that Liverpool can—if the inference from your facts is correct—be supplied with milk without preservatives?—Certainly.

5300. You say 875 samples were examined for borax, and only 17 out of the whole number contained borax?—Yes. During the first nine months of the year 1899.

5301. Were those samples examined for formalin?—Yes.

5302. And for other preservatives?—Not for any other preservatives.

5303. They were all examined for borax and for formalin?—Yes.

5304. And for borax derivates?—For all forms of borate.

5305. Do you think the other half of this total number of 875 can be taken as a fair representation of the rest of the district for which you are analyst?—I do not think it could be taken with the same amount of generality because the number of samples purchased is very much less in proportion to the population.

5306. You say that legalising the use of formalin will deteriorate the average quality of the milk sold; by veiling the effect of uncleanliness, would you mean?—Partly that, but also, I think, very largely because the preservation of separated milk for the purpose of adulteration is, to a great extent, bound up with the possibility of using a preservative in it.

5307. You mean, I take it, that if preservatives are allowed there is less necessity for insisting upon a rigid cleanliness than without them?—Yes, I do mean that.

5308. With regard to the instance of the lime juice cordial in which you found 108 grains of salicylic acid in a gallon, could you tell the Committee about how much lime juice cordial a child might be reasonably expected to take?—I should think half a tumblerful, that would be about 5 ounces.

5309. How much salicylic acid would be contained, say, in half a tumberful in the case of the lime juice cordial containing 108 grains?—It would be about 3½ grains.

5310. With regard to the orange wine, how much orange wine do you think a child might take possibly?—I suppose that is usually taken by wine glasses, and a small wine glass holds about 2 ounces.

5311. 106 grains is found in a gallon of that?—Yes, in orange wine. That, again, is something similar; it would be about a grain and a-half in each wineglassful, so they might take 3 grains or so.

5312. You are not a medical man, are you?—No, I am not a medical man.

5313. Do you think with regard to limiting the amount of boric acid, there would be any difficulty from the public analyst's point of view in ascertaining whether or not the maximum amount has been exceeded?—As regards the boric acid?

5314. You say that you think formalin should be prohibited, and boric acid limited in quantity, and that samples should be labelled, "Preserved by so-and-so per cent. of boric acid." Do you foresee any difficulty in practice in carrying that out?—No, I do not see any particular difficulty in it. The remark quoted applies to potted cream.

5315. There is no difficulty to the analyst in ascertaining a small quantity of boric acid?—No, none whatever.

5316. (*Dr Tunnicliffe.*) I think you said you obtained a conviction in a case of formalin?—Yes.

5317. Could you tell me upon what ground you got your conviction there?—Largely upon the ground that I have stated this afternoon, namely, that it was not neces-

Mr. W. C. Williams.

19 Jan. 1900.

sary to use any preservative at all in milk, and it was therefore a foreign substance and an adulteration.

5318. On the ground of its being of the nature of an adulterant?—Of its not being of the nature, quality, and substance of milk.

5319. Not on the ground that it was injurious to health?—No; it was under Section 6 of the Food and Drugs Act, not under Section 3.

5320. Did you have any evidence of the formalin in that case being injurious to health; did you attempt to proceed under that other section of the Act?—We had evidence from Professor Boyce, who is the bacteriologist for the City of Liverpool. He said that in his opinion it was injurious to health.

5321. What I meant to ask you was this—the sample of milk which you spoke of contained a relatively large quantity of formalin?—Yes.

5322. As far as you are aware did it cause any injury to the people consuming the milk?—I do not know whether it did or not.

5323. If it had done I take it you would have known?—I should not have heard of it.

5324. I take it it would have been used in evidence in the case?—Probably it would if anything had been known, but the injury is not likely to be of that startling kind.

5325. With regard to the cream which contained a large quantity of boric acid, why do you say that that was injurious to health; did you have any evidence of that fact?—No, it was merely our opinion; it was quite unfit to take.

5326. In your synopsis you say that in one sample of raspberry jam, which contained no salicylic acid you found fungi and spores?—Yes.

5327. Was that sample of jam bad to the ordinary taste?—No, not at all.

5328. Did you form any opinion as to whether those fungi and those spores were pathogenic?—They were fungus spores.

5329. Ordinary fungus spores?—Yes.

5330. Mould spores?—Yes.

5331. These ten samples of jam that you examined were relatively early in your research, were they not?—Yes, those were, it was about 1897 that those were specially examined.

5332. Do you happen to know the fact that a great deal of jam is made in this country from imported pulp?—Yes.

5333. Do you think that the addition of preservatives is unnecessary in such jam?—Yes, I should think so. The pulp as imported is perfectly sound, and contains no preservative.

5334. You think it might perfectly well be sterilised, or something of that kind?—Certainly; I think the boiling would effect it; in fact it is apricot pulp principally that is used in that way, and apricot jam is one of the jams in which we find no preservative most frequently.

5335. In that jam which is known to be made from imported pulp you find the preservatives are less frequent than in the other types of jam?—Yes.

5336. Do you happen to know whether the skin of the lemon or the lime is usually incorporated in making lime-juice cordial?—I am not certain. I cannot say positively.

5337. (*Chairman.*) Have you much to tell us about colouring matters?—I think the most important point is in regard to copper in peas.

5338. In regard to dairy produce, I think we need not trouble you, as we have had ample evidence from other sources. Now what have you to tell us about copper in peas?—We almost invariably find that peas are coloured green by compounds of copper, and I think this is a practice that requires very strict control at any rate. The quantity we now find is much less than used to be found formerly, and a very small quantity of copper seems to be quite effective in producing sufficient greenness in peas.

5339. On what do you ground your opinion that the use of copper is less frequent?—It is not less frequent, but the quantity used is smaller.

5340. Can you give us any evidence as to that?—In 1892 I examined six samples, and the quantity ranged from 0·8 up to 2½ grains per lb., reckoned as crystallised sulphate of copper. In 1893 I only examined two samples, and that was in each case about a grain. Some samples of beans in that year contained about a grain and a half. In 1895 we met with 2½ grains again in one sample. In 1897 from half to three quarters of a grain; in 1898 from a quarter up to 1·8; in 1899 from half a grain up to a single grain. I am speaking of my own personal experience, but previously to this, Dr. Campbell Brown, who also signs the *précis* with me, used to find very much more than that; I believe 3 and 4 grains was not uncommon.

5341. When you are making an analysis for copper in peas what quantity do you submit to experiment?—About 100 grammes usually. We take about 100 grammes of the sample—that is 2½ ounces.

5342. I ask that because it has been represented to us that there is a difficulty in distributing the copper equally throughout, say, a lb. of green peas, and that one part of it will be found more fully impregnated with copper than another?—The samples have always been well mixed up together before any was taken out for analysis, so they ought to be quite uniform. Besides, 100 grammes is a good large quantity to take for analysis, and ought to represent a very fair average of the sample operated upon.

5343. Have any proceedings been taken?—Yes, a considerable number of convictions have been obtained for copper in peas in Liverpool at one time and another. Proceedings are taken for anything over two grains, I believe. Of course, I do not have the direction of the prosecutions, and I cannot give you official figures for them. At present they have not taken a grain and a-half into court. The smallest quantity that I have found is a quarter of a grain, and in that case the peas were certainly quite as green and quite fit for use—as green as anybody would desire to have them, and if it is possible to use successfully a quarter of a grain I do not see why any more should be used. Also in connection with the same subject I made some investigations as to the degree to which the copper penetrated the interior of the pea, because it was contended that the copper remained on the surface only. I found that the copper got right through the outer skin into the interior, and also that about 40 per cent. of the total amount of copper was capable of being digested by artificial digestion experiments, the remainder of course being indigestible. It was contended, among other things, that the copper was quite indigestible and was not assimilated, and passed through the system without change.

5344. The figures submitted in your note as to the analyses in successive years scarcely support your assertion that the quantity of copper now used is less than formerly?—I very rarely meet with a sample now that contains more than a grain and a-half.

5345. (*Professor Thorpe.*) Per lb. of sulphate of copper?—Yes; whereas formerly 2½ grains would be quite a common amount—and 3—or more.

5346. (*Chairman.*) As lately as 1896 you took one sample, and it contained 2½ grains?—Yes; that one was convicted and fined.

5347. In spices have you found a variety of colouring matters?—I know that many spices are artificially coloured, but I have never been able to separate the colouring matter so as to be able to identify it. It is evident that many samples of pepper are artificially coloured, because they are of a colour that natural pepper never is—very often quite bright yellow; and their composition indicates that they have been subjected to a very stringent washing process which has washed out nearly all the soluble constituents from the ash. The object of the colouring, I take it, is because the public prefer to have their pepper yellow rather than of the natural colour, and such pepper can be sold in preference to natural coloured pepper even of the best variety, spices, as a rule, being sold more on the basis of their colour than on their intrinsic value. The effect of colouring of that kind has no bearing as far as I can see on health, but it enables an inferior sample to supplant a superior one in the market. A similar sort of thing occurs with ginger; bleached ginger is commonly preferred to unbleached ginger.

5348. Do I understand you to say that the quantity of colouring matter is so small as to escape detection by analysis?—That is so in the case of pepper.

5349. Both pepper and ginger?—I do not suspect added colouring matter in ginger—it is rather that the natural colour has been modified by bleaching for the purpose of conferring a different tint upon the sample.

5350. Would you consider any good purposes would be served by imposing the necessity of a declaration in the case of an artificially coloured article?—I think in many cases it will serve a very good purpose in preventing fraud, because in a large class of the cases where colouring is resorted to the sole object is to imitate some other substance, or to make an article look better than it really is. But I do not think that applies all round. I cannot see that there is very much harm in colouring butter or cheese, and certainly I do not see any harm in colouring confectionery and fancy goods generally, provided the colouring matter is not injurious to health.

5351. (*Professor Thorpe.*) But you would say colouring milk might be an offence?—Certainly, that might be.

5352. (*Chairman.*) Why?—Because it is making it appear rich when it is not, or concealing adulteration.

5353. What is the object of colouring butter?—The object of colouring butter is to make it a colour that people prefer to have, I take it; but it does not conceal the fact that it is butter or make it look like anything other than butter.

5354. Does it not make it look like a richer quality of butter?—I do not think so. I do not think I should judge the quality of the butter by its colour at all—not as a member of the public. I would not like to have it quite white.

5355. Is it not the case that butter taken from the Channel Islands cattle is of a notably high quality?—I have had little experience of butter taken from that part of the world; it does not come up to Liverpool and Lancashire.

5356. You do not know anything about Alderney and Jersey cattle?—Only by repute.

5357. Does the repute convey to you that it is a well-known breed of butter-producing cows?—Yes, but my impression is that it is rather as regards the quantity of butter obtained from the milk than the actual quality of the butter itself.

5358. Would you prohibit the use of colouring matter in vegetables?—Copper in peas, I would.

5359. Vegetables generally—peas being a vegetable?—If not prohibited, I think that it ought to be strictly limited to a very small quantity; I do not know whether it could be fairly prohibited absolutely.

5360. Why not?—I do not think they would be saleable without being somewhat coloured. The effect of copper on the colouring matter of preserved peas is certainly very remarkable. It seems to have an effect in fixing and producing an intensely green compound with the products of decomposition of chlorophyll formed on boiling; the effect is a great deal more than the mere greening effect of the blue salt—a very small quantity is apparently enough.

5361. It is such an interesting chemical process that you would be inclined to condone it. Now, as to jams, have you found much colouring matter in jam?—I have found jam that has been dyed with a red dye, but the quantity and the nature of the dye I am not aware of.

5362. Have you found it frequently?—No, not frequently. I have also, since the proof was sent in, examined several materials used by butchers for colouring sausages and meat, and I have found in those cases a red coal tar dye used, which appeared to be one of the sulphonated diazo reds, corresponding pretty closely to xylidine scarlet. We found this in a substance called "Indian red colouring," and in "rose-pink colouring," and "polony dye," "sausage colouring," and another preparation called "smokene," a material which is intended for making smoked sausages without smoking them. This dye is a solution of borax and salt, with a trace of creosote added to it; it evidently would make the meat taste smoky, and, of course, it would be red, and also would be more or less preserved.

5363. Do you think that a desirable process?—No. These occult processes, I think, are decidedly undesirable in the case of meat. I do not see any necessity to colour meat with aniline dyes.

5364. If you allow green peas to be coloured with copper, is it any worse to colour your sausages with another chemical?—It is not any worse. I do not think that it results in any injury to health, and I do not know that it indicates any particular fraud.

5365. Can you draw any distinction in principle between colouring sausages red and peas green?—There is this, that peas are naturally green and sausages are not naturally red.

5366. Meat is more or less naturally red, is it not?—Yes, but not after cooking. There is this distinction, of course, that the colouring matter in the sausages and meat is not known, at any rate, to be injurious to health, whereas copper is.

Mr. W. C. Williams.

19 Jan. 1900.

5367. (*Professor Thorpe.*) The copper is injurious to health?—Yes.

5368. (*Chairman.*) You have advocated the retention of the practice of colouring with copper?—I did not intend to advocate its retention, but I see some difficulty in its absolute abolition, because I do not see quite how the trade can be carried on without the use of a small quantity of copper or some such material for colouring the peas.

5369. At all events, you speak with high admiration of the results?—I was pleased to find that as good a result could be obtained with so small a quantity, so very much less than had been formerly used.

5370. You have not the same sympathy with the vendor who colours his meat articles for food?—No, because there is no necessity to colour meat with a dye.

5371. Then, apparently—you will excuse me—the only ground I can see whereon you base a distinction is the particular part of the spectrum of which the rays are reflected?—(*No answer.*)

5372. (*Dr. Tunnicliffe.*) You state that you made some digestion experiments with copper?—Yes.

5373. Could you just tell us what they were a little more fully than you have done so far?—I treated a certain quantity with hydrochloric acid and Benger's Liquor Pepticus.

5374. A certain quantity of peas?—Yes, and placed it in an incubator for about three hours, and then filtered and determined the copper in the filtrate. The same thing with the pancreatic preparation.

5375. And you got the result that about 40 per cent. of the original copper was present in the filtrate?—Yes.

5376. From that you assume that that proportion of copper would be absorbed by the stomach or by the intestines, as the case may be?—No, I do not think that follows. It is obtained under those conditions, but, of course, in the presence of other matters in the stomach it might be rendered insoluble again, or combine with the membranes of the stomach. It means this, that about 40 per cent. of the copper in the peas is introduced in a soluble form into the stomach, and is not an inert insoluble substance passing through the system without affecting it. That is the contention which I wished to test—whether the copper in the peas was in an absolutely insoluble form and would do no more harm than so much sand, or whether it would actually amount to the ingestion of a certain amount of soluble compound into the body, and, therefore, might be assumed to have the same effect as a soluble copper salt.

5377. With regard to smokene, do you know whether it contained any collidine or picoline?—I do not know. I had not enough of it to make that out.

5378. Of course, if it did do so you would agree that it was still more to be deprecated?—Certainly, but the amount of organic material of that kind was so extremely small that it was hardly enough to identify; it was merely just enough to give it a smell.

5379. Do you know anything about colouring matters in cocoa, tea, or coffee?—I have not met with them myself beyond the addition of alkali to certain kinds of cocoa to make it of a darker colour. That was the addition of a substance for modifying the original colour of the substance, but not the addition of a colouring matter.

5380. Regarding your statement that what was reckoned as a quarter of a grain of sulphate of copper per pound is sufficient to keep peas coloured, have you made any time experiments—what I mean to say is, do you know for how long a time peas so treated would retain their colour?—No; I do not know how long they retain it. The peas came from France, so they were, presumably, not recently made.

5381. Were the peas that came from France perfectly coloured?—They were perfectly well coloured.

5382. When they came into your hands there was a quarter of a grain of copper to the pound?—Of copper sulphate; about one-fourth of that of actual copper.

5383. It was reckoned as copper sulphate?—Yes, it was reckoned as crystallised copper sulphate.

5384. (*Dr. Bulstrode.*) How would you propose to regulate or to control this question of colouring matters?—It is very difficult to make a workable proposition.

5385. Do you know that the practice is common abroad in Continental countries to have schedules in which colour-

Mr. W. C Williams.

19 Jan. 1900.

ing matters containing certain metals are excluded and others allowed?—It might be possible to do something of that kind. I should feel inclined to admit certain exceptions such as butter and cheese, but as a rule to say that only colouring for fancy purposes should be permitted.

5386. For fancy purposes?—Yes, such as you meet with in confectionery and such like things. There can be no possible harm in that, and one would hardly like to prohibit that provided the colouring matters were harmless.

5387. You do not think it would be possible that whatever colouring matters are used there would be risk?—As far as my experience goes I have never found anything injurious used of recent years; there has been nothing more than the ordinary aniline colours in very small quantity.

5388. In former years have you found injurious substances used?—Yes; there used to be lead chromate and things like that, but that was before my time.

5389. What is the largest amount of lead chromate you have found?—I have never found lead chromate in confectionery.

5390. I understood that it had been found in sugar-oranges and lemons?—It was Dr. Campbell Brown who found that; I never met with it.

5391. Just reverting to preservatives for a moment, could you furnish the Committee with a table showing the population of the several towns, and also the rural districts from which you draw your supplies, giving the percentage of the number of samples of milk analysed for preservatives and the percentage in which the preservatives of one and another kind were found?—Yes, I daresay I could furnish that.

5392. All these are towns in which there is a large proportion of poor people, I believe?—Yes.

5393. (*Professor Thorpe.*) Copper, I suppose, is usually classed as a poison, and its salts are poisonous salts, are they not?—Yes.

5394. Are iron and oxide of iron usually classed as poison and poisonous salts?—No.

5395. I gather that on your *précis* you say that cocoa nibs are habitually coloured by Armenian bole or other red oxides of iron?—Yes, I am not responsible for that statement, that is Dr. Campbell Brown's statement.

5396. Do you agree with Dr. Campbell Brown's statement that "it is a filthy practice, which should be checked by requiring such samples to be labelled as coloured by so and so"?—I do not know that I have thought much about it.

5397. You do not agree with that?—It is a matter that has not come before me personally.

5398. Abstractedly do you agree that when a person is liable to have cocoa nibs more or less charged with red oxides of iron, he should be informed of that fact?—I think he should be informed of it.

5399. Without expressing any opinion whether it is a filthy practice or not you think he should be informed of the fact?—That is an adulteration.

5400. He should be informed that his cocoa-nibs have been adulterated?—Yes.

5401. I suppose you would equally be inclined to allow him to be informed of the fact that his peas are coloured with what you have admitted to be a poisonous salt?—Certainly. I think they should be labelled.

5402. What is the object of colouring the peas?—To make them appear like fresh peas.

5403. They are not fresh peas?—No, they are preserved.

5404. Therefore it is to make them appear like something which they are not?—Yes.

5405. Does that not strike you as something in the nature of a fraud?—In the abstract it is.

5406. Is not a customer prejudiced by buying something which he has not asked for?—No, because he sees them; he sees them in the bottle.

5407. Supposing they were in a tin?—He sees them in a tin; he knows he is not buying fresh peas; he does not get them in the same shop.

5408. (*Chairman.*) The consumer does not see them in the bottle?—No, but the consumer usually consumes them at a time when he cannot get fresh peas.

5409. (*Professor Thorpe.*) He may or he may not; if he goes into a restaurant he does not know what he gets?—No, from that point of view of course he does not.

5410. Is he not prejudiced therefore by getting something which he does not want?—The actual consumer may be, but the actual purchaser is not.

5411. I suppose the things are purchased to be consumed, are they not?—Yes, but then the person who purchases them is the person whom the law considers.

5412. I think the terms of our reference show that we are rather considering the consumer, are we not?—I dare say.

5413. No doubt the whole question is a question of public health that we are asked to enquire into. I think you wish us to believe that a person who buys stale peas artificially coloured so as to resemble fresh peas is prejudiced?—The person who consumes may be.

5414. Put it that way—the consumer is?—Yes.

5415. And, of course, *a fortiori*, he is prejudiced when he is consuming something which you have admitted is a poisonous salt?—Yes.

5416. I put it to you, how can you defend the addition of copper in peas under these circumstances; and, with these admissions, why do you defend the presence of copper in peas?—I do not defend it. I should be glad if it were entirely prohibited.

5417. I understood you in response to the chairman to say that at all events you were willing to condone it on the ground that you thought it was rather a pretty chemical experiment?—I did not say that, but I am prepared to think that a quarter of a grain in the pound does not do any particular injury to health.

5418. Then at all events the person buying those peas as if they were fresh peas—that is, the sonsumer of them—is prejudiced?—That is a different point of view altogether.

5419. Still, I am taking the whole thing as practised?—That is a different matter.

5420. Is it a different matter? You have told us, for example, in the case of milk, that it is a fraud to artificially colour milk, because it is done to make it resemble something which it is not, namely, a rich milk?—Yes.

5421. Why is it not equally a fraud to colour peas?—Because the person who buys the milk has no means of judging; he cannot see for himself that the milk is adulterated milk, whereas the purchaser who purchases peas sees for himself that he is not purchasing fresh peas.

5422. Does he know what he is purchasing; does he know anything about the peas?—He knows they are preserved peas, and he takes them for what they are worth.

5423. Under the supposition that they were or may be fresh peas?—No; he knows that they are not fresh peas.

5424. You come back again to the consumer; we are dealing really with the consumer?—Yes.

5425. The consumer, of course, knows nothing about it. He has served on his plate some things which are green, and which he supposes in the innocence of his heart are fresh peas?—Yes.

5426. It is not so, and they are not fresh peas?—No.

5427. And the consumer is thereby prejudiced?—Yes, he is prejudiced certainly.

5428. (*Dr. Tunnicliffe.*) I should like to ask if Mr. Williams would be good enough to furnish us with the reference to that conviction of formalin which I think is the only conviction of formalin in milk that we have had?—I could get the information.

5429. Would you kindly send the reference?—Embracing what details?

5430. Embracing the whole case; the more we know the better. You can send up an account in a daily paper of the time?—There was no considerable account published, I think.

5431. Anything that you could furnish would of course be much more valuable than that, but I was thinking of saving you the trouble?—I will do the best I can.

Dr. James Robert Kaye, called; and Examined.

Dr. J. R. Kaye.

19 Jan. 1900.

5432. (*Chairman.*) I believe you hold the degrees of Bachelor of Medicine and Master of Surgery, and the Diploma of Public Health of the Cambridge University?—That is so.

5433. You are also a Fellow of the Chemical Society and Honorary Secretary of the Yorkshire Branch of the Incorporated Society of Medical Officers of Health?—That is so.

5434. Since 1880, I think, you have held public appointments, including the Medical Officership of the County Borough of Huddersfield?—That is so.

5435. You are now Medical Officer of Health for the West Riding of Yorkshire County Council?—Yes.

5436. That is a large area, is it not?—Yes, that is so.

5437. What is its population?—The population at the 1891 census was 1,351,570.

5438. That area includes a number of sanitary authorities, I believe?—Altogether 162 sanitary authorities—13 boroughs, 119 urban districts, and 30 rural districts.

5439. Now, the inspectors who make their reports—— to you, I suppose?—Yes.

5440. Have had their attention specially directed to the Adulteration Acts, and have generally given attention to the food supply of the district?—Yes. There are nine inspectors in all.

5441. Has there been brought under your notice an increase in the practice of adding preservatives to food?—Yes. I might just say that when this Committee asked for information from the West Riding County Council I brought the matter before the West Riding Sanitary Committee, and they immediately authorised a special investigation into the matter, and I immediately proceeded into this investigation as far as dairy products, milk, and butter were concerned; and that is about the length we have gone, but the investigation will of course continue now.

5442. Your attention had not been specially directed to it before last autumn?—It had been just at intervals, but not specially.

5443. Then there have been no prosecutions in your district?—None for preservatives.

5444. What was the result of the inquiry which you directed last autumn?—The result of the inquiry and also of a little previous experience is that the use of preservatives is greatly on the increase, especially during the last two or three years. We have found milk dealers and dairymen using it, and we have found butchers and farmers using it, and even tripe-dressers we have found resorting to the use of preservatives. In a time of hot weather we took seventeen samples of milk; we found out thirteen had boracic acid or formalin, while thirteen samples taken in the cold weather (in October and November) were found entirely free, and yet they were taken under similar conditions.

5445. Were they taken from the vendors?—Yes, from the vendors.

5446. From the shops?—In the streets and in the milk shops.

5447. Were you given to understand that they found the use of preservatives necessary?—The majority of them that I have spoken to say that they are necessary.

5448. Did they succeed in convincing you of their necessity?—Certainly not.

5449. What is your opinion as to the expediency of the use of those articles?—I think with regard to dairy produce they are absolutely unnecessary. That is my experience.

5450. You will not go further than to say that they are unnecessary?—No.

5451. Do you think that they are desirable?—Certainly not—not in the slightest degree.

5452. I suppose sanitary authorities enforce stringently the provisions of the Dairies, Cowsheds, and Milkshops Regulations?—I wish I could agree with you; I do not think that they do very rigidly. Some of them do, but others I am afraid are somewhat lax.

5453. Evasion of the regulations is rather facilitated than otherwise by the use of preservatives, is it not?—Entirely so.

5454. That is to say, a vendor using preservatives would not be obliged to observe such scrupulous cleanliness as one not using preservatives?—In my opinion that is perfectly correct. I do think that often the use of preservatives, and the great increase that has occurred in my district, is partly accounted for in that way. It makes a lazy man, for instance, think that he can use cold water for cleaning his vessels, instead of boiling water and scalding them. It saves him trouble there. I know that they have got wonderful ideas about the preservatives apart from the actual fact of their preserving the milk. There is, for instance, the idea of counteracting any insanitary conditions in cowsheds, the idea of their having some effect where the milk from a cow, say, with an inflamed udder, is of a little red colour. I am giving you cases that have come under my own observation. Then there is the question of the excessive use of brewery grains, and their prematurely becoming sour, and the counteracting effect of the preservatives in that respect. All these ideas are in the mind of the milk producer, and the preservatives are practically used to conceal those deleterious actions.

5455. Have you taken any quantitative analyses of these samples?—We have, but I have not given in my proof the quantities that were found in each of the samples. What I did is shown in Table A (*see App. No.* 30), which perhaps you will kindly look at. I took throughout the Riding a number of articles, and of these I selected five—I had half-a-dozen, but one got broken on the way. The table gives in the first column the name under which the article is sold, and I think you have the original labels on the bottles in your possession now; at any rate, I think I sent them up to your secretary. In the second column I give the directions for use which were placed on the bottles, but calculating the whole thing out to grains per pint and grains per pound. That is a point I should like to bring before you. You see there is a great variety of dose in the various articles. You will notice that in the first one, arcticanus, for butter, the instruction is to use 31 grains per pound, and in the last one (Ramsden's milk preservative), 125 grains per pound. If you take sausages you will see that of arcticanus 30 grains per pound are to be used, whereas of Burton's household milk and food preservative it is 45 grains per pound.

5456. These preservatives, I think, are all either compounds of boric acid and borax or else pure boric acid?—In the third column I have given the analyses. Arcticanus, you will see, consists of 85·5 per cent. of boric acid and 14·5 per cent. of borax, conservine has the same composition, and Burton's household milk and food preservative and Coverdale's meat preserver consists of pure boric acid.

5457. I see that the last one, Ramsden's milk preservative, you did not analyse?—No, that was not analysed; practically we had not time.

5458. I think you have made some quantitative analyses of butter?—Yes. One sample of butter I have got the figures of. That sample of butter contained 0·77 per cent. of boric acid; it was bought as butter, and it turned out to be partly margarine with this boric acid added to it. That is a point that I want to bring out—that it seems from our experience that it is more frequently those samples that have been adulterated in some way that preservatives are used in, than it is the case with practically good genuine fresh milk and butter.

5459. I see that in the notes with which you have supplied the Committee you say that you have known as much as 20 grains of boric acid to a pint of milk?—Yes, I have.

5460. Do you remember how you got that sample?—It was taken just in the ordinary way.

5461. The ordinary way might lead you either to a large vendor or to a small retailer?—In this case it was a small retailer and distributor of milk in the country. Most of our samples are taken from these smaller distributors throughout the whole of the West Riding.

5462. It looks as if this extraordinary quantity had been put into the milk as it passed through successive hands?—That is my opinion. More than that, in the samples I have given you you will see that dredgers are utilised. I have known a butcher, with a dredger, after the cow is killed, immediately dredging the whole of the carcase with it. We discovered that about two or three months ago. In the same way with milk they are beginning to use these dredgers with no reference whatever to the dose. Now, will you kindly look at the last

Dr. J. R. Kaye.

19 Jan. 1900.

column of Table A? You will see from that that any man reading what is on the bottles is allowed to believe that arcticanus is "absolutely harmless and pure," that conservine is "harmless and effective," "safe and reliable," "none need be afraid to use it." The next preservative is "harmless and effectual," and the last one is "totally harmless to the most delicate child"—and yet one is advised to use 11 grains per pint of milk.

5463. I think you said no proceedings had been taken?—We were contemplating proceedings; in fact, my committee had given me instructions to take some proceedings in the matter, but then this Committee began its work, and we thought it advisable to simply proceed with our investigations, because if we had taken proceedings then some of the vendors of course would have given over using it no doubt, and therefore the results of the inquiry would have been fallacious.

5464. You have practised as a surgeon, I believe, as well as a physician?—Yes. Practically the whole of my life has been spent in public institutions and in health work, but at home I have several relations, medical men, and I used in my earlier days to work with them.

5465. Have you formed any opinion as to the effect upon the community of the indiscriminate use of preservatives?—Yes. From what experience I have had I think there must be some effect. I have attempted somewhat argumentatively, I might say, but still, at the same time, I think I have brought it so far as that perhaps you will think my figures are towards that point—I have attempted, as I say, to prove that this rapidly increasing use of preservatives in every article of food that you can lay your hands on has something to do with the public health. I have done that by taking milk alone and its effect on infantile mortality. Will you kindly look at Table B (*see App. No.* 30). This I attempt to show the relationship. I take twenty years, from 1878 to 1897 inclusively, and I divide that time into five year periods. I show in that table that the number of deaths of infants under one year per thousand births has been in the first period 142, in the second 143, in the third 146, and in the fourth and last 152. So that you see instead of having any improvement we are going very much towards Table B (*see App. No.* 30). There I attempt to show by another set of figures in column 3 of Table B. Assuming that the infantile mortality in the period 1878-1882, namely, 142 per thousand, had been maintained, in the next period we would have saved over 4,481 infant lives; if that rate, 142 per thousand, had been the rate of the third period we would have saved 17,788 infant lives; and if that rate of 142 per thousand had existed in the last period we would have saved no less than 45,641 infant lives. In the fourth column I show that while we have this great increase in the deaths of children under one year of age, whose food is principally milk, we have at the same time a remarkable decrease in the general death rate, the average general death rate per thousand living of all ages decreasing from 20·3 in 1878-82 to 17·8 in the last period 1893-97, these percentages representing a saving of several hundred thousand lives. Of course, the question then arises, what are the factors that are producing this increased infantile mortality? I daresay medical men would immediately say that it is a question of factory employment; then there is the question of the servant difficulty, and of mothers going out to work more than they used to go, the result being that the child is neglected at home. On that I would say that this factory employment, and the employment of mothers away from their homes otherwise, goes on the whole year round. Now, I am going further to attempt to show that the increase is practically limited to the third quarter of the year, the third quarter of the year being the quarter in which the maximum amount of milk is used amongst children, and probably I am going to show to some extent that although it may not be *the* factor, still the use of preservatives in milk does to some extent play a part in the production of this enormous and startling sacrifice of infant life during the third quarter of the year. I would ask you to kindly look at Table C, where I attempt to show that (*see App. No.* 30). In the first place I have given you the figures for England and Wales, then for thirty-three large towns, then for five county boroughs in the West Riding of Yorkshire, and then for the West Riding Administrative County. Why I have chosen those is because I think that in the first (England and Wales) and the last (the West Riding Administrative County) you will get the rural element, whilst in the second and third (the thirty-three large towns and the five county boroughs in the West Riding) practically it is industrial. If you look at the second column, giving the number of infant deaths under one year per thousand births, during the eight years 1891-98, you will see that in England and Wales it was 152, in the thirty-three large towns 171, in the five county boroughs 176—the two latter coming very near one another—and in the West Riding Administrative County 154, which corresponds more to the infantile death rate in England and Wales. Now, if you break that up into quarters and take an average of the first quarters of the eight years, you will find that in England and Wales the death rate was 147, in the thirty-three large towns 152, in the five county boroughs 154, and in the West Riding Administrative County 145. If you take the eight second quarters in the same way practically you find similar figures. If you take the eight third quarters in the same way, you find an enormous increase, namely, 183 in England and Wales, 229 in the thirty-three large towns, 259 in the five county boroughs, and 171 in the West Riding Administrative County. Going to the eight fourth quarters you see the corresponding figures are only 150, 163, 165, and 161. If you go further into the analysis of those figures which I have here worked out in detail you will not only find that practically the whole of the increase is in the third quarter, but you will find also that in the infantile mortality there has been practically an improvement in the last eight years in the first and second quarters, while in the third quarter it has gone on increasing till the last year in the West Riding, when it was no less than 224. With regard to the eight fourth quarters you will see that the figures are stationary. Therefore, my argument is this, that you have in the first, second, and fourth quarters stationary figures or improvement, and in the third quarters you have a remarkable excess of the infantile death rate considering the great sanitary progress that has been made, and the improvement in the general death rate. This increase in infantile mortality in the third quarter must be due to something unusual, and the question is what is that which is unusual? As far as I can see the use of preservatives is unusual, and is growing every day, and, therefore, I am inclined to put down some of this infantile mortality during the third quarter to the excessive use of preservatives during that quarter, that is, during the hot season of the year.

5466. You have already spoken as to the excessive use of preservatives in your district—the West Riding of Yorkshire?—Yes.

5467. I see that you go outside that in order to found inferences from the statistics, and you take thirty-three large towns?—Yes.

5468. Those, I presume, include Liverpool and Birmingham?—They do.

5469. Are you aware that in Birmingham the use of preservatives is absolutely prohibited in milk?—Now, but not at the period of these figures—up to 1898.

5470. Not up to 1898?—That is so. That is one of the reasons why I have stopped there. I looked at the influence that the investigations of this Committee might have, and therefore I have gone back to that year.

5471. Then you look forward with interest, no doubt, to the effects of the prohibition of preservatives on the Birmingham returns in the future?—I shall.

5472. That will be a rather interesting test of your theory?—Yes, it will.

5473. Is it, however, safe to assume that in all those thirty-three large towns the use of preservatives was as general as it has proved to be in Yorkshire?—From what I know going throughout the country and conferring with my brother medical officers I think I am justified in assuming that. There is one qualification that I have found out in the West Riding, and that is, where co-operative societies are most in existence. There the least amount of preservatives seem to be used, because they seem to get rid of their stock much more quickly. I do not know whether there is anything in it, but I have found that out from my figures.

5474. (*Dr. Bulstrode.*) Could you tell us for how long in the past the chief incidence of infantile diarrhœa has been upon the third quarter of the year?—Yes, I have the detailed working here. Do you desire it in England and Wales, or in any one particular district?

5475. Take England and Wales?—In England and Wales it has practically been so all through; but it is rather difficult to follow the figures.

5476. It is sufficient to say, perhaps, that the excessive incidence of infantile diarrhœa has been in the third quarter all through?—That is so, practically all through—and it is more so in the last four or five years.

5477. I take it that you would hardly wish to establish that infantile diarrhœa, that autumnal diarrhœa in other words, is due to the use of preservatives, but that you wish to establish that the use of preservatives may be a factor in preventing infantile diarrhœa from falling—is that your position?—Yes, that is so. I also hold this position, that the use of preservatives, although it prevents perhaps the milk becoming manifestly and visibly sour, at the same time may not prevent other action in the milk going on which is deleterious to the infant.

5478. You mean, I take it, that you do not necessarily regard the ordinary indices of decomposition in milk as a gauge of the mischief which may be taking place?—Not necessarily so.

5479. Can you give us evidence in support of that view?—One case that I recollect distinctly is a case of the concealment of insanitary conditions, as it were. The milk vendor in the place said to me that he got his milk from three farmers, and he complained that one farmer's milk became sour very much sooner than the others; in fact, that it would not keep till the evening. I went to that man's farm after hearing the complaint, and when I got there it was just at milking time, in the evening. I saw the milk-can there standing in the middle of the cow-walk in the cow-shed, and not very far away there was a cartload of brewers' grains. I suggested to the man the advisability of taking the can out of the cow-shed and of removing the brewers' grains, because of this complaint. He said: "Oh, no; I have been keeping my milk for many a long year in this way, and I have had no complaints." "That does not alter the case," I said. I suggested to him that he might find out that it was due to some herb in the fields. That he was not disposed to listen to. Ultimately I persuaded him to keep the milk outside the cow-shed always in a proper place, and to remove the brewers' grains. I heard no more complaints afterwards. I spoke to the seller of the milk subsequently, and he said the milk after that, whatever had been done at the farm, had kept much longer. Whether the original complaints were due to the insanitary condition of the cow-shed I cannot positively say, but the assumption is that there was something in that.

5480. Is that the only fact which you can put before us in support of the statement as to the lactic acid being the only indication of decomposition?—Yes, I think so.

5481. With regard to this excess of infantile diarrhœa in the third quarter, could you tell the Committee whether that has been so practically always?—Yes, practically always.

5482. When to your knowledge did the use of preservatives become at all general?—I should think that it is within the last seven years that I have known that pretty general.

5483. Then your figures would seem to show that there was some cause operating before that time?—Yes, I quite admit that.

5484. Do you think that is possibly due to the presence of preservatives which could not be detected?—No, I say we are not improving. We are getting more and more infantile mortality as years go on. No doubt if you take the previous fifteen or twenty years you will find that the infantile mortality was greatest also in the third quarter, that being due to other causes such as the decomposition of milk and so on. But when you take into consideration that during the first, second and fourth quarters there is no increase, and there is practically an improvement in the infantile death rate, I say that this excessive infantile mortality in later years must be due to some unusual cause, and that unusual cause I put down to the increasing use of preservatives.

5485. If this thesis of yours is true, you would expect to find, would you not, in the figures for Birmingham and for Liverpool a very material diminution in infantile mortality?—I do not know about Liverpool. I might in Birmingham.

5486. If they have followed the same course in Liverpool you would adduce the same arguments as regards Liverpool as you have as regards Birmingham, and you would expect that the action they have taken there would lead to a marked diminution?—Yes, but I do not think that you can really argue from a city like Liverpool. The administration of a place like Liverpool is so very difficult, even in the way of the use of preservatives. In a great deal of what passes into Liverpool I should think there are preservatives in spite of the administration of the city—there must be.

5487. We may tell you that in Liverpool, during the months when infantile diarrhœa is the highest, assuming that it follows there the usual course, there would be no preservatives at all used in the milk. We gather that from the fact that none were detected, although a considerable number of samples were examined in the months of July, August, and September?—They must be particularly honest folks there.

5488. Furthermore, perhaps we might point out that out of 875 samples of milk which had been taken from Blackpool, Blackburn, Barrow, Liverpool, Bootle, and the administrative county of Lancaster during a whole year, only seventeen were found with preservatives in. I only mention that to show that if your thesis is a true one it is probable that in the next figures we get, that is, in the figures for the last year, we may find some indication of improvement in those districts?—I hope so.

5489. During what time are preservatives mostly used; do you know?—Of course our enquiries have been limited to what I have done. It seems to be in the hot weather. In the month of September, when we took those samples, we found out that over seventy per cent. had preservatives in them; but when we came to the cold weather and took a few samples—we took thirteen samples—we found out that they were practically free from preservatives.

5490. What class do you think would be most likely to get the preserved milk?—I think that the working classes are likely to get the preserved milk, because, as I attempted to show, it is generally the milk that has been adulterated to some extent that these preservatives are found in more than in the genuine milk; and the genuine milk is the milk that goes to the better class trader.

5491. We have been told that the infantile diarrhœa in the large towns is due, not to preservatives, but to decomposed milk—I mean that partially decomposed milk, not recognisably decomposed, which is sold amongst the poor; do you think there is very much evidence in support of that?—I think there is some evidence in support of that undoubtedly; I quite agree with that.

5492. If that were true, and the effect of preservatives tended to check the decomposition of milk, would you not expect to find some diminution of infantile mortality since the introduction of preservatives?—No, I do not think so, because the increased use of preservatives, I think, counterbalances any good that they might have overcome in the way of postponing decomposition.

5493. Do you think that the decomposition goes on in spite of the preservatives?—I do not say actual decomposition, but some other changes in the milk may go on in spite of them.

5494. Which may produce diarrhœa?—Yes, which may.

5495. Your knowledge of the extent to which they are used at present would not be very great?—No, not very.

5496. You are proposing to carry on your investigations over another hot season, I understand?—Yes, for two or three years, I hope, we will carry this on now.

5497. Do you think that it will give you much further information?—I think so. I think it will help us anyway to find out if the prevalence is confined to the hot weather.

5498. You say in your synopsis: "The use of preservatives means increased profits by maintaining saleable in the eyes of the public that which would otherwise be refused"?—Yes.

5499. Would not refrigeration, sterilisation, and pasteurisation come under the same argument?—No, I do not think so.

5500. Assuming that the preservatives are used properly, I take it, that the object of all these processes is to prevent multiplication of germ life?—That is so.

5501. Then why would you not put them all in the same class?—Because those that generally use sterilisation and refrigeration do it immediately with the fresh milk.

5502. Provided the preservatives were added to the fresh milk what would be the difference between the one and the other process?—The one would be that in the sterilisation and refrigeration there is no deleterious agent added, and in my opinion the boric acid which is added in the preservative is deleterious.

5503. That, of course, is what we are inquiring into?—Yes. I had my attention drawn pretty sharply to that immediately after I graduated. It was the custom at home in a very large practice to give honey and borax, *Dr. J. R. Kaye.*

19 Jan. 1900.

and in looking up for the preparation of this I found in the British Pharmacopœia that it was made up with boric acid; and I made it up with boric acid. A month afterwards my uncle returned to the practice, and found there was a number of severe cases of diarrhœa, and from his experience of over 30 years he immediately said that he had no doubt that the boric acid was the cause of the persistence of this diarrhœa in the children.

5504. Was that your opinion?—Yes, it was my opinion; of course, I agreed with him.

5505. How much boric acid was each child taking, do you think, at that time? That is important. If you could supply the Committee with evidence—I mean circumstantial evidence—which points to that having been the case or likely to have been the case, it would be valuable. Could you tell us about how much each child would be likely to take?—I do not know that I could tell you how much, because in a country district, when one is very busy, dispensing is not very accurate with regard to such applications as a mouth wash.

5506. You say that 54 grains of boric acid in a pint of milk would be dangerous; do you think that is a dangerous amount?—Yes, I think that is a dangerous amount.

5507. Supposing there were 54 grains in a lb. of butter, how much boric acid do you think an ordinary adult would take in the course of the day through that alone?—I think he would perhaps take about three ounces of butter a day in one substance and another, puddings and so on.

5508. It would not be very much boric acid from that alone?—No, not from that alone.

5509. You say in your synopsis: "The proportion of treated articles to the daily dietary is an important factor. In infancy or in sickness the dietary consist almost entirely of articles such as milk, which has been doctored, and thus the proportion of actual preservative to the total amount of food consumed would be increased." Do you see very much danger to invalids and infants from the indiscriminate use of these preservatives?—Most certainly. As I mentioned, it is a custom now to order cream. I have lately met friends whom the doctor has ordered to take a tablespoonful of cream twice or three times a day; it is becoming fashionable.

5510. For what?—In cases of consumption, where the patient could not take cod liver oil. A young solicitor only about three months ago was ordered by a doctor a tablespoonful of cream, and when I mentioned this case about preservatives he was very anxious to give up the cream. But I dissuaded him, and asked him to go on with it, because I had had a little sample of it, and had found out that there was nothing in the cream whatever.

5511. Do you think this question is of importance chiefly in relation to invalids and infants, or do you think it affects the whole community?—I think if it is going on at the rate it is going on now and progresses, we certainly will have injury to the public health; but the evident injury at the present moment is to invalids and to children.

5512. The evident injury would you say?—Yes.

5513. Would you say there is much actual evidence pointing to the ill-effects of any one preservative—actual evidence so far without discussing the presumptive evidence?—I would not say much; I say there is evidence. Of course the information with regard to the physiological effects is scarce, but one does come across cases where you cannot but assume that the action of the boric acid has been prejudicial.

5514. You are conversant with all the physiological experiments, I take it?—Yes.

5515. In what direction do you think they point so far?—I think that they point to injury.

5516. Which more particularly—would you quote the experiments that you consider most point in that direction?—I think that the experiments on formalin have undoubtedly proved that that is injurious.

5517. Whose experiments now are you referring to?—Liebreich's experiments with regard to formalin, I think. I cannot exactly give the name of the investigators, although I have read them all.

5518. You say further on in your synopsis: "Any preservative to be effective in retarding or preventing putrefaction, must have some injurious influence upon the delicate digestive organs of many people—*e.g.*, infants and invalids." Would you still say "must have"?—Yes, I think I should, knowing as I do a good deal about disinfectants and these things, I think boric acid would have that effect.

5519. I gather it is your opinion that if cleanliness in the preparation of milk were properly enforced throughout the country there would be no need for preservatives?—Yes. I think to a large extent their use now is simply a cloak.

5520. For the results of dirtiness?—Yes, of dirtiness.

5521. Have you any detailed knowledge of the milk trade, and of the methods of milking and storing cattle?—Pretty well; I have been amongst it myself all my life at home.

5522. In your knowledge is there much cooling of the milk going on?—It is increasing every day in the West Riding.

5523. It is increasing there, you say?—Yes, as the farmers are getting to know more about it. Just as the information which is spreading about with regard to preservatives is causing their use, so as information spreads about with regard to refrigerators they are increasingly made use of. It is simply a question, I think, to a large extent of the spread of knowledge.

5524. It has been used as an argument in favour of the use of preservatives before this Committee that there is a great difficulty in getting a proper water supply in many of the dairies; would you regard that as an argument in favour of using preservatives?—Certainly not; I would say it is an argument in favour of obtaining a proper supply of water—which they all can get, although it may be a question of cost.

5525. Is it not practically compulsory upon all dairies and cowsheds to have a proper water supply under the Dairies, Cowsheds and Milk Shops Order?—That is, the regulations?

5526. It is a part of the Order itself, not a part of any special regulations, is it not?—Yes, it is a part of the Order.

5527. (*Dr. Tunnicliffe.*) You say that the suckling of children by mothers, in your district at any rate, is greatly on the decrease?—Yes, that is so.

5528. Do you know anything about the relative use in your district of tinned milks?—Yes, I know some little about it. We had an instruction to take up a case of prosecution of one of the largest farms that we could think of.

5529. I may stop you there perhaps; I may take it that you agree that its use is very extensive?—It is in certain quarters.

5530. And increasing?—That is so.

5531. Are you aware of the relation so far as the presence of preservatives is concerned between tinned and fresh milks?—No, we have not got that length in our investigations yet; we intend to take that point up.

5532. Therefore it will be news to you when I tell you that 83 samples of tinned milk—condensed milk, so called—were examined for preservatives, and in no instance was a preservative found in them?—Yes, but I should not be surprised.

5533. At what time of the year do you think the use of tinned milks would be most prevalent, speaking *a priori*?—I think that those who rather use the tinned milks generally use them the whole year round.

5534. You think they are used the whole year round indiscriminately?—Yes. I think that the class of people who do use those milks use them the whole year round.

5535. Are you aware of the fact that many of these tinned milks are not only insufficient from the point of view of their nourishment, but contain large quantities of fermentable sugar and other irritant substances from the point of view of digestion?—I quite agree with you.

5536. Do you not see to some extent in this extended use of tinned milks an explanation of the fact that the infantile mortality from diarrhœa has been kept up?—No, not to that extent. The use of tinned milks in the West Riding is largely due to its use for tea and so on in the better classes. The working man is not the man who goes in for the tinned milks; it is the better classes of society.

5537. That is your experience?—That is my experience, but only my experience.

5538. May I ask if you ever have had any connection with a children's hospital?—Yes, I have.

5539. In recent years?—Twelve years ago.

5540. Perhaps it will be news to you to know that 60 or 70 per cent. of the poor people in London use tinned

Dr. J. R. Kaye.

19 Jan. 1900

milks?—No, I know that they use them very greatly in London.

5541. For children, I mean?—Yes, I know that they do here.

5542. Still under those circumstances you still refuse to think that the tinned milks have anything to do with the diarrhœa?—No, I quite agree that the tinned milk foods in London are greatly used. All that I say with regard to the use of preservatives is that they are not the principal factor, but that they play a part in this otherwise unexplainable increasingly high mortality throughout the country in the third quarter of the year.

5543. You would expect any cause that tended to produce diarrhœa, whether it were due to the infant being ill, or to the introduction of some irritant, to operate in the third quarter of the year, would you not?—I do not follow you there.

5544. Children at that time of the year are more susceptible to diarrhœa, whatever may be the cause, than at any other time of the year?—No, I would not altogether say they were more susceptible; it is due to the conditions of course; the climatic conditions render them more susceptible.

5545. That is what I mean?—Under certain climatic conditions and under certain sanitary surroundings I do not see why they should be more liable to diarrhœa in the third than in any other quarter.

5546. The climatic conditions obtaining in the third quarter of the year are more favourable to the development of diarrhœa than the climatic conditions obtaining in the other quarters of the year?—That is so. I quite agree that they hasten decomposition.

5547. You still think that because a preservative has an inhibitive action upon the health of a low organism it must necessarily interfere with digestion?—That is my humble opinion.

5548. Can you give us any reasons for that opinion?—Only this, that in my work with disinfectants if any agent like boric acid will attack these low organisms like the fungus and moulds, I think they will attack the epithelium and other fine membranes in the digestive tracts.

5449. You are familiar with the action of potassium bromide as a drug, I take it?—Yes.

5550. You are familiar with the fact that it acts upon the ganglion cell and not upon the nerve ending?—Yes, that is so.

5551. Structures which are to a certain extent alike?—Yes.

5552. Would you still hold then that a substance like boracic acid would not discriminate between a putrefactive organism and so different a thing, from a protoplasmic standpoint, as the secreting cell of the gastric mucous membrane?—My position is that in experimenting with boracic acid when individual doses and so on are taken as medicines the premises are altogether different to what they are when boracic acid is in everyday use. Here you are having boracic acid mixed with practically every article of diet—mingled with the food, remember. In a medicinal dose you take it some time before or some time after your food, and it is not dealt with in the same way, but taking it constantly, permanently, and indiscriminately, and those men being allowed to use it as they like—"Because one man uses it I must use it," one man aping the other, there seems to be no finality in the use of these preservatives unless it is stopped.

5553. (*Chairman.*) As I understand, you do not found more than a suggestion upon the increased rate of infant mortality in recent years?—No, my idea was to take up some point which perhaps had not been done before. I just looked for some point that had not been taken up, and I worked this one.

5554. You are aware that that phenomenon has already been made the subject of discussion?—I know it has been made a matter of discussion.

5555. You have heard the conclusions to which the late Sir Richard Thorne pointed as not impossibly connected with the milk supply?—No, I did not know that.

5556. That it might arise from the fuller milk supply of the population being also a more constant source of infection from tuberculosis?—With all respect to the late Sir Richard Thorne, of course, *tabes mesenterica* is a much less cause than boracic acid, I think. I prefer my own theory with regard to diarrhœa.

5557. (*Dr. Bulstrode.*) With regard to this question of diarrhœa, have you made a study of the diarrhœal curves in places like Copenhagen, Brussels, and Vienna, where no preservatives are used?—Not intimately.

5558. Can you tell the Committee any way in which you think they point?—I have looked at the figures, and taking my general reading it struck me that the infantile mortality in those places is less, comparatively speaking, than in our third quarter.

5559. (*Dr. Tunnicliffe.*) You recommend, I understand, sterilisation of milk?—I do.

5560. Are you aware of the fact that sterilised milk is less digestible than fresh milk?—I do not know that it is less digestible—I do not see that it is.

5561. There is strong experimental evidence to that effect, and I ask if you are aware of it?—No, I am not aware of it. I know that in Ripon City they have begun to sterilise their milk, and they are using it very freely, and they are increasing its use every day, even amongst the working people, and they like it very much.

Mr. OTTO HEHNER, called; and Examined.

Mr. O. Hehner.

5562. (*Chairman.*) You are public analyst for Nottinghamshire, West Sussex, the Isle of Wight, and the Boroughs of Derby and Ryde, I believe?—Yes.

5563. And you are also a Fellow of the Institute of Chemistry?—Yes.

5564. I believe you have made prolonged investigations into the prevalence of preservatives?—Yes, I have during many years tested very many samples, I believe I may say a good many thousand samples of articles of food for preservatives. Formerly, for a long time, I kept statistics about the prevalence of these preservatives, but I have not done so latterly. That was mainly in relation to butter. I have tested many other articles, but as to butter I have examined a very large number.

5565. We have received a great deal of evidence on the subject of preservatives in butter, and I think we are tolerably familiar with the various practices of the trade; have you any observations to make on the subject?—I may say that I have not seen the full reports of the evidence given before the Committee, and, therefore, no doubt, have included many things in my *précis* which were unnecessary. By far the greater proportion of the samples of butter I have examined contained a preservative; I daresay I may say at least 90 per cent. of all the samples which I have examined did.

5566. Is that preservative generally one of the boric compounds?—I may say always. I have examined frequently for other preservatives, but I have found none, except salt of course. The quantities which I have found are sometimes very small, sometimes amounting to as much as one per cent., but mostly being about half a per cent., or a little over.

5567. I believe you have also tested butter for the presence of colouring matter?—Yes, frequently. Nearly all the butter as we get it in the South of England is coloured; in the Midlands I have sometimes met with uncoloured butter.

5568. Have you found any colour prevalent except annatto?—Yes, lately in very many cases I have found an aniline colouring matter. A few years ago it was entirely annatto, but now it is a substance something akin to methyl orange or some aniline colour in very small quantity.

5569. Those are supplied, I suppose, to the manufacturer in the form of some patent colouring?—Yes.

5570. Do you think they are ever present in sufficient quantities to be injurious to the consumer?—No, I think not; the quantity is exceedingly small.

5571. Even of such substances as Martius' yellow?—I have never met Martius' yellow in butter, and it has never been used to my knowledge. At the same time, I may say that it is very difficult, with the quantities of butter at the disposal of the analyst, and the very small quantities of colour that are used, to identify such a colour. I have had many samples of colour submitted to me in the state of colour not mixed with the article of

Mr. O. Hehner.

19 Jan. 1900.

food. I have never met Martius' yellow, which is a poisonous colouring matter.

5572. Have you found any colouring matter in milk?—Yes, it is continually present—almost invariably in the London milk.

5573. Do you think that is a desirable practice?—No, I think it is a deceptive practice, and undoubtedly was due originally to the milkman being anxious to hide the blueness of his milk. At the same time, it is such a universal practice now that the consumer would probably refuse the natural milk if he got it.

5574. Is that any argument for regulating or prohibiting it?—No. I do not like the practice. At the same time it is not a matter which I think calls for urgent attention. I would rather see it done away with than retained, however.

5575. It is to this extent fraudulent, is it not, that it simulates a superior article to an inferior one?—Yes; originally the intention was fraudulent.

5576. (*Professor Thorpe.*) You have, I know, such a very large experience in these matters that, although it is getting late in the day, you will not mind my asking you a few questions, as we should like to get the benefit of your experience. It is within your experience, is it not, that cream which is sold by milkmen is, as a rule, free from preservatives?—Yes, that is my experience; I may say at the same time that I have met preservatives in milks which have been sent to me by inspectors in the district which I work, but a very large number were free from preservatives. I rarely find preservatives in milk. My experience, such as it is, differs from that of my colleagues in other districts. I have found both formalin and borates, but not frequently.

5577. Of course, your work as a public analyst is very largely connected with what we may call country and rural districts?—Quite so.

5578. (*Chairman.*) Does it include Nottingham?—It does not include the borough of Nottingham.

5579. (*Professor Thorpe.*) So that, of course, you are practically dealing more particularly with country milk?—Yes.

5580. Would you infer from the fact that such samples as you do get of milk are free from preservatives, that there ought to be no essential necessity for the use of preservatives?—I do not see any necessity whatever for them.

5581. Coming now to the question of cream, is your experience also confined to cream obtained from milk supplied in country districts?—Of course I have experience of cream from there also, and I have found no preservatives there. I have had numerous samples of milk and cream from a very large dairy company in London, which I have been advising for many years, and I have found no borax or any other preservative.

5582. Have you taken any samples of cream from grocers?—I have taken very many.

5583. Do you find that they, as a rule, contain preservatives?—Almost without exception.

5584. And that preservative is what?—It is always a boric preservative. I have analysed many of the preservatives which are sold to the trade, and they are, as a rule, mixtures of borax and boracic acid made in a particular way; they are neither pure borax nor pure boracic acid, although both occur in them. In those creams there are always borates. I have determined the amounts in many cases, and I have found them up to about 0.8 or 0.9 per cent., which would mean 56 grains per pound, or thereabouts.

5585. I believe you have a considerable professional connection with certain distributing houses—produce merchants and others?—Yes, I get a great many samples from them, mainly as applying to butter.

5586. As a result of that experience, are you led to infer that the use of boracic acid, or, speaking generally, boracic acid preservatives is more necessary to grocers than it would be to ordinary milk sellers and dairy people?—In the case of butter?

5587. In the case of cream?—The grocer probably could not sell cream if it were not preserved unless he obtained it as the milkman obtains his milk, once or twice a day fresh from the country.

5588. Is that a condition of his trade which he can very easily obtain?—Certainly. If a grocer chooses to keep milk or cream he must conform to the conditions which the real vendor of milk or cream has to comply with. The grocer wants to make the public believe that cream is not a perishable article in the ordinary sense of the term, and he keeps it in his shop as long as it is wanted.

5589. But it is not the practice, with the possible exception of very fresh butter, for a grocer to stock anything which is of that character that he must get rid of it very rapidly?—No, as a rule it is not.

5590. The general character of his trade then leads him to stock articles——?—To stock articles which will keep.

5591. And, therefore, if he inclines to sell cream he has a strong inducement to adopt preservatives?—Yes.

5592. There is no particular reason in your judgment why grocers should sell cream, is there?—I do not think there is any reason, except that they are misleading the public in making the public accustomed to think that cream is an article which will keep.

5593. In your opinion do you see any reason why preservatives should be employed in food generally?—No, generally I do not. I think generally it is an abuse, and it is misleading the public to make them think that articles which in the natural course of things are perishable will keep longer than they naturally do.

5594. In that general statement would you include butter?—With some qualification.

5595. What are the qualifications?—If the butter is produced, as it is frequently by large dairies, and can reach the consumer quickly, I see no earthly reason why there should be any preservative used in it. The practice of using preservatives, the very rise of which I have followed, originated in the collection from small farmers, who brought small bulks of butter which had to be stored till a sufficient quantity was obtained, and they could not at that time get it to keep, and therefore a small quantity of boracic acid was added.

5596. In your experience where does the greatest quantity of the very fresh butter go; what class of people consume it—we will take the Normandy butters, the high-class, delicately-flavoured butters with no salt in?—I should say they go mainly to the well-to-do people.

5597. To the class of people, I suppose, who, at afternoon tea, put such butter on their bread or on their toast, and afterwards liberally dust it with salt from a muffineer?—I do not know; I never saw the practice. That varies much in different parts of the country. In the south of England hardly any appreciable quantity of salt is used. In the Midlands and in the North you will find a great deal.

5598. In the upper classes, at all events, where this very delicately flavoured butter that we have heard something about from Normandy or Brittany is used, is it not the general social practice that when you take afternoon tea at such houses a muffineer containing salt is the invariable accompaniment?—Yes; but I may say I have not often seen it used.

5599. Would it not strike you therefore as either an absurd practice for anybody to buy butter which necessitates the use of these preservatives, with the possible injury that there may be from their constant employment, and then put salt in that kind of a way on the butter?—Yes; but at the same time, it would be quite a mistaken idea to think that only the so-called high-class, delicately-flavoured butters, which are mostly exceedingly insipid things, contain boracic acid. Not only the very commonest butters, but the commonest margarines which want no preservatives at all, contain boracic acid. I think there is no difference made in that respect in regard to the quality.

5600. I know that; but this is the point I want to get from you—it is because a certain class of the community demand these bland, so-called delicately-flavoured butters that leads to the necessity of boracic acid being put into them?—No doubt that is very much the case. Salt, at least in the South of England, is getting used in smaller and smaller quantities in butters, and no doubt it is more difficult to keep butter entirely free from salt, or with only 0·2 or 0·3 per cent. of salt in it than it is with a larger quantity, hence the preservatives. But at the same time Danish butters, which are almost as bland as Normandy butters—not quite—are free from preservatives.

5601. They are free from preservatives, do you say?—Yes, and they are practically free from salt. They may have a nominal amount of salt in them, because they are washed with salt water. The amount of salt in them at any rate is very small, and there are some Danish butters quite free from salt, and also free from preservatives.

5602. Do these Danish butters which are free from salt—and, of course, as we know, by law they are free from preservatives—keep a reasonable length of time?—They are imported into England, where they command a good price, and they are imported from Denmark into France. Paris has a considerable sale for absolutely unsalted Danish butters. Those butters cannot keep so long as the others, but they command a good price, and they are good butters.

5603. There is no practical difficulty in vending them under the conditions without the use either of salt or of preservatives?—I think there is not. The difficulty is mainly in the collection. In the case of margarine, I may say, I think that the addition of preservatives is entirely unjustifiable, because margarines will keep without them.

5604. There is no necessity for them?—There is no necessity for boracic acid.

5605. Have you anything further to tell the Committee with respect to the use of preservatives in dairy products, speaking generally?—No. I must say I do not like the preservatives, as a member of the community and as an officer who has to look after the food supply of the people; but I do not think that any regulation should be made, possibly even in the interests of trade, to suppress preservatives entirely or at least sternly. I think regulations are very urgently necessary to regulate their quantities; it should not be left to the grocer or to the butter-man to add from a castor or from a sprinkler as much as he chooses—as is done now. The boracic acid gives a decided flavour to the butter, and the public are now accustomed to the boracic acid taste, and presently they will not take a butter which does not contain boracic acid if their palate is so entirely misled as it is being now.

5606. You say therefore that you would not prohibit it, but that you would regulate its use?—I would regulate it, and I would regulate it if I saw it was practicable in such a way as to gradually diminish the quantity as other facilities are given to the producers to do without it. It is as I say mainly in the collection of the butter that the difficulty comes in.

5607. Putting butter for the moment aside, do you see any absolute necessity for the retention of the preservatives in the case of milk?—Absolutely none.

5608. Would you think it practicable to prohibit their use in milk?—Certainly, to absolutely prohibit it.

5609. But in butter you would rather regulate it?—I would like to prohibit it, but I see a greater difficulty in the case of butter. I repeat I would prefer to see it prohibited, and I believe prohibition would be of immense benefit not only to the consumer but to the agriculturists of the country.

5610. Formalin, of course, is never used in preserved butter?—I have never met with it. I believe experiments have been made with it, but they were not successful.

5611. Is formalin a preservative which on general grounds you would prohibit the use of?—I would absolutely prohibit it. Formalin is a most injurious substance. I have made experiments upon myself, unfortunately, with formalin, certainly in somewhat stronger solutions than are used in milk. I had for a number of days most violent pains in the epigastric region with it.

5612. (*Dr. Bulstrode.*) What was the strength of it?—The experiment was made some years ago, and I took no notes of the strength, but I think it was one in 5,000. I am sorry that I have not got the quantity now, and I do not want to repeat the experiment.

5613. (*Dr. Tunnicliffe.*) One in 5,000, you say?—Yes, one in 5,000 of a formalin solution, and it certainly made me very ill.

5614. (*Professor Thorpe.*) Then I gather from you the only preservative you would condone the use of is boracic acid and borax preservative?—And that only, if it were practicable, under certain conditions.

5615. And in butter?—Solely in butter for the time being until the manufacturers have made their other arrangements. I would give them notice that after a certain time I would not allow more than 0·4 per cent., and after another year or so would only allow 0·2 per cent., and so stamp it out.

5616. But what really is the difference, what serious dislocation would it make to the trade or to anybody if it was prohibited in a more drastic method than that?—We import something like 16 or 17 million pounds of butter every year, of which a large proportion is preserved.

Mr. O. Hehner.

19 Jan. 1900.

5617. But a very large proportion is not?—I think far the larger proportion is.

5618. What do you mean by "far the larger"?—I should say at least three-fourths of it.

5619. Three-fourths of it is preserved?—Yes, preserved with boric acid. I speak from impressions without having looked at the statistics. I think by far the larger proportion is preserved, and I believe it would make a temporary dislocation of the trade if you prohibited it. It would be to the benefit of the English farmer, and I admit that I do not see why, for instance, we should take from France butter which is preserved with boric acid, whilst the Frenchman is carefully guarded by his Government from eating that very butter which we have to consume here.

5620. (*Chairman.*) The Frenchman is guarded from eating that butter, do you say?—Yes, from eating preserved butter.

5621. Is that so?—I am not aware of any French law, but I was in communication with M. Girard some time ago, who is the chief of the Municipal Laboratory of Paris. He tells me that they do not pass any butter that is preserved with boric acid. I have a letter here from his laboratory, in which I am told that the Comité Consultatif d'Hygiene of Paris has reported and recommended that the use of boracic acid should be entirely suppressed, and that they have acted upon that.

5622. The digestive apparatus of Englishmen is presumably more robust?—We have done the same thing; when we have got a very bad sample of tea we do not give it to the Englishman to drink, we export it.

5623-24. (*Professor Thorpe.*) Can you tell us anything about the use of boracic acid in meats, fish, bacon, and so on?—Yes, I have met with herrings which were simply full of boracic acid. I have also found boracic acid in very many samples of ham which I have tested from time to time, and sausages. I have met with boracic acid in them. I have met it in anchovies; in one case I met both boracic acid and salicylic acid at the same time. I have met also with boracic acid in meat extracts, and things which ought never to require any boracic acid whatever, and where I do not see any excuse for its having been used.

5625. Is the boracic acid which you have found in bacon due to the possible penetration of the borax which has been used in the process of packing or actually has the bacon or ham been cured by boracic acid?—That is what I cannot say. I have seen a clean side of bacon packed, as it were, in boracic acid; I have also seen in bacon-curing factories in London boracic acid used pretty liberally.

5626. Injected?—No.

5627. Simply dusted on?—I have seen it dusted over.

5628. Now you have I think an opinion which you would like to lay before the Committee on the subject of copper in peas; would you kindly tell the Committee what conclusions you have arrived at in that respect?—I think that the use of copper in peas is a practice adopted solely with the intention to deceive. I can see no shred of reason why it should be supported. Peas which have been boiled and put into a bottle or tin are not green, and I do not see why the public should be made to believe that they are green; and although I do not think that there is any strong evidence—I have tried to follow it—that copper produces ill effects in the quantities which are, as a rule, used now, I do not see why a poisonous substance should be permitted knowingly to be added in any quantity. If a vendor thought he could preserve, we will say, meat or butter, with mercuric chloride in a very small quantity, far smaller than could actually, or would probably, produce injurious effects, I do not see why he should be permitted to do so. Neither the vendor nor the manufacturer should be allowed knowingly to add anything which is injurious, whatever the dose may be.

5629. Your point is that copper sulphate is in principle similar to corrosive sublimate although not possibly in degree?—Quite so. With corrosive sublimate, of course, everyone would say the limit of safety is very easily overstepped, and you could not permit it; in the case of copper sulphate it is not so easily overstepped.

5630. Still there does come a point even in copper sulphate where it is distinctly poisonous?—Yes.

5631. (*Dr. Bulstrode.*) Your statement that considerably more than half the butter which is imported into England contains preservatives, I think is not quite correct. May I read to you from Whitaker's Almanack for the current

Mr. O. Hehner.

19 Jan. 1900.

year? It says: "In the year 1898 the quantity of butter imported from foreign countries was 2,813,736 hundredweights, rather more than half of which was imported from Denmark"?—Whatever the statistics may be, I judge from my experience. I get samples of butter from all parts, not only of London, but from England generally, from traders of all descriptions. Frequently, in fact, mostly, I do not know where the butter comes from, but I think I get a fair average sprinkling of all the imports. I believe that 90 per cent., if not more, of all the samples which I have examined—certainly of all those which I have lately examined—are preserved.

5632. If this statement in Whitaker is true, it rather throws a doubt on the Danish methods?—I am not a statistician, and I cannot criticise those figures.

5633. These figures are taken from the Board of Trade Returns?—I think we import a far larger amount of preserved butter at present. I saw some days ago that we imported about 16 millions, and I think Denmark does not give us half of that. Still that is a matter which inquiry at the Board of Trade will settle.

5634. I rather understood you to say that you objected generally to the use of preservatives because they gave the idea to the public that the foods so preserved would keep longer than they would keep without preservatives?—I believe that the addition of preservatives makes articles of food keep somewhat longer, otherwise they would have no justification whatever.

5635. I rather understood you to condemn them on this ground: that they gave the public an impression that they would keep longer than was really right?—That is not the only ground on which I should condemn them.

5636. May we take it you would condemn the use of nitrate of potash?—I would not condemn it; I would not like it, but at the same time I meet with it very rarely.

5637. What about the use of salt?—Salt is a substance which we do want in our food just like we want sugar, which is also a preservative, and as most of us want alcohol.

5638. Then you would differentiate between the preservatives?—Between things which are at the same time food materials, or, at least, are the normal constituents of all food, and those which are drugs to us. I do not see why a grocer should drug me.

NINETEENTH DAY.

Monday, 22nd January, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P. F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary.*

Mr. H. D. Richmond and Mr. I. A. Hattersley.

MR. HENRY DROOP RICHMOND and MR. I. A. HATTERSLEY, called; and Examined.

5639. (*Professor Thorpe.*) (*To Mr. Droop Richmond.*) You are analyst to the Aylesbury Dairy Company, Limited, I believe?—Yes.

5640. You have had considerable experience in the analysis of dairy products?—Yes.

5641. Do the Aylesbury Dairy Company employ preservatives at all?—They do not employ preservatives in milk, cream, butter, or in any product which is made by them.

5642. Or sold by them?—Preservatives are contained in some of the butter which is imported and sold by them.

5643. What is the general character of the preservatives used in milk or other dairy products?—I have a table here giving an analysis of some of the preservatives. They come chiefly under two heads. The first is those which are composed of boric acid and borax; those vary a good deal in proportion, some of them consisting entirely of boric acid and others of about three of boric acid and one of borax. That seems to be the most favourite mixture.

5644. Have you analyses of these?—Yes, I have. Shall I read them out?

5645. I think it will suffice if you will kindly hand them in.—Yes, I will hand them in. (*See App. No.* 31.) Then there are also two samples which I have examined, which, besides containing boric acid, also contain salicylic acid; one was in the form of a powder, and it contained borax and salicylic acid, and the other one was in the form of a liquid, and contained 12½ per cent. of free boric acid and about 13 per cent. of salicylic acid combined with soda and magnesia in a glycerine solution.

5646. Are those figures contained in the table you have just handed in?—Yes, they are.

5647. Then, in addition to those mixtures of borax and boric acid, and also salicylic acid formaldehyde is used, is it not?—It is.

5648. In what form is that used?—It is sold to the trade, as a rule, in a solution containing 1 per cent. of formaldehyde, but I believe a stronger solution containing 40 per cent. is also sold.

5649. Is formic aldehyde very much used?—I have not any experience personally; but from what I have heard, I believe that it is largely used.

5650. Of the preservatives that you have mentioned, which are preferred by milk producers and vendors?—I think the preservative which finds the most favour is a mixture of borax and boric acid in the proportion of three parts of boric acid to one of borax. I think that that and formalin would be used in approximately equal quantities.

5651. Have you arrived at any opinion as to the hygienic effect of these preservatives?—I hardly think I am qualified to speak on that point.

5652. Are you aware of any specific action which formalin exerts upon the constituents of milk?—Yes. When formalin is added to milk it appears to combine with the proteids, probably the casein chiefly. That is shown by the fact that when milk containing formalin is heated with hydrochloric acid, the casein which is precipitated takes very much longer to be dissolved by boiling than if no formalin has been added.

5653. Do you deduce anything from that fact?—I say first of all a combination has taken place, and then there is some ground for assuming that the casein is in a more insoluble form, and probably a form which is harder of digestion.

5654. Which is more difficult of digestion?—Yes; but I would not like to say that that conclusion is entirely justified.

5655. Why do you make that qualification?—Because the action of strong hydrochloric acid at the boiling temperature is not comparable to the action of the gastric juice and the other digestive juices of the body.

5656. When you are speaking of the action of strong hydrochloric acid, you are speaking, of course, of the action as seen under the Werner-Schmidt process, are you not?—Yes, that is so.

5657. But, surely, if the action of the strong hydrochloric acid is to break up the casein in that process, you would imagine that the action of a relatively dilute hydrochloric acid such as exists in gastric juice would be equally inhibited by the action of formic aldehyde?—Yes, I should think so; but then I do not think I should be perfectly justified in assuming that the action of digestion is entirely due to the hydrochloric acid of the gastric juice; there are also pepsin and the other enzymes.

5658. No doubt; but then in so far as hydrochloric acid is of service in gastric juice, its action would be prolonged if it had to break up this hardened form of casein?—Yes, that is so.

5659. I presume the same substances that you have mentioned as being used in milk are also used in cream?—Yes, they are. I should like to also add that in cream there is another substance used which might come under the heading of preservatives, as it would be indirectly a preservative—that is, a solution of lime in cane sugar syrup, which is known by the name of "viscogen."

5660. Saccharated lime?—Yes, I have examined a sample of that, and find it contains about 5½ per cent. of lime. The primary object of adding that to cream is to make it look thicker, but it is an alkali, which would neutralise any acid formed by the action of micro-organisms, and would thus indirectly act as a preservative—that is to say, it would prolong the time necessary for the formation of the amount of acid which would curdle the cream.

5661. That is to say, by combining with any free acid as fast as it was formed?—Yes.

5662. It would prolong the curdling action?—Yes.

5663. It has no direct antiseptic action?—No, it has not.

5664. It merely retards the time at which the curdling and the evidence of sourness to the consumer are shown?—Yes, that is so. Then also with regard to the preservatives in cream, the same substances are used, but they are prepared in a slightly different form. The mixture of borax and boric acid which is added contains in some cases cane sugar, but far more often saccharin.

5665. Saccharin?—Yes, to give a sweet taste to the cream.

5666. Is that sold as a commercial preparation?—It is sold as a commercial preparation; it is usually called "Special Cream Compound."

5667. The Aylesbury Dairy Company, I understand, formerly used a small quantity of boric acid in cream?—Yes, it was added to the extent of 0·2 per cent. in cream.

5668. They no longer use it?—No.

5669. Why have they relinquished the use of it?—I think the chief reason for giving it up was that it was found that it was objected to by a considerable section of the public. Then, after experimenting we found we could supply cream in a fresh state without the use of preservatives.

5670. Not even the saccharate of lime?—No.

5671. Or this composition containing saccharin that you have mentioned?—No.

5672. None of these things, I understand, are used by the Aylesbury Dairy Company?—No. We do not use any preservative of any kind in cream.

5673. Have you at any time used boric acid as a preservative in butter?—Yes, we used it some years ago.

5674. Do you use it now?—No.

5675. How was the boric acid introduced?—We had two ways of doing it. The first was to wash the butter with a solution of boric acid directly after churning, when it was in the granular form, the other method was to mix the boric acid in the butter on the worker, and work it in.

5676. When you washed the butter with the boric acid solution was any boric acid retained by the butter?—Yes. I have some figures here which give you the quantities. The maximum quantity found under those circumstances was 0·094 per cent. of boric acid, calculated as boric anhydride; calculated as the commercial preservative it was 0·177 per cent.; the minimum was 0·042 of boric anhydrides, or 0·076 of commercial preservative; and the average was 0·076 of boric anhydrides and 0·136 of the commercial preservative. May I add that the commercial preservative is calculated from the boric anhydride, which was estimated by dividing by the factor 0·568, and is based on the average of the table that I have handed in, which shows that commercial preservatives contain on an average 56·8 per cent. of boric anhydride.

5677. In that case did you use boric acid, or did you use a preservative?—We really used boric acid itself. I might also add that the figure 56·8 per cent. of boric anhydride, which is found in commercial preservative, is practically the same as the boric anhydride in boric acid, which is 56·3, so that the figures that I have given as a commercial preservative would, without any practical error, represent boric acid.

Mr. H. D. Richmond and Mr. I. A. Hattersley.

22 Jan. 1900.

5678. When you formerly added boric acid what was the amount that you thought necessary to add?—We used to put in one-half per cent.

5679. Now, I understand, you have entirely done away with that practice?—Yes, we have.

5680. Why have you found it advisable, or desirable, or possible to do away with it?—It was done away with in butter for the same reason that I have stated, it was done away with in cream, namely, because we found there was a prejudice against the use of preservatives.

5681. Your customers, in fact, objected to it?—I do not know that we had any direct complaints from customers, but we saw in the public press from time to time articles which deprecated the use of it.

5682. You thought, therefore, it was politic to do without it?—Yes, we did.

5683. Have you had any trouble in consequence of doing without it?—No, I cannot say that we have.

5684. The butters from France that you import are habitually preserved, are they not?—Yes.

5685. What is the average amount of preservative which is contained in them?—The average quantity of boric anhydride which was estimated is 0·336 per cent., and this calculated by the same factor as the commercial preservative was 0·599 per cent., or practically 0·6 per cent. I have here figures showing the maximum, the minimum, and the average percentage of boric anhydride and boric acid in French butters, and in the butters washed with boric acid solution.

5686. That paper you will also hand in?—Yes. (*See App. No. 31.*) That will give you the figures I have read out.

5687. Do you still continue to sell those butters?—Yes.

5688. In your judgment is boracic acid required in such butters?—I think that in the case of butters which are collected on the same system that the French butters are, which are imported to England, and have to pass through the hands of two or three different people, perhaps there might be some trouble in keeping them for the necessary length of time if something were not added. I do not think, however, that the use of boric compounds is absolutely necessary.

5689. Not even for these butters?—Not even for those butters. I think that an equal percentage of salt, or rather a smaller percentage of salt can be substituted for that with equally good results.

5690. Would you mind telling me what class of customer is in the habit of buying these French butters?—I think perhaps that is a question which you had better ask Mr. Hattersley. He will be able to deal with it much better than I shall.

5691. Danish butters I believe contain no preservatives?—No. I have found them free from preservatives.

5692. Does the Aylesbury Dairy Company deal with Australian butters?—To a certain extent; we have not a large amount of Australian butter.

5693. Are they invariably preserved?—Up to last year I have found them invariably preserved.

5694. Up to last year?—Yes; but last year I had one or two samples which were free from preservatives.

5695. Were those good saleable butters?—Yes, I should say so.

5696. There was no difficulty in selling them?—No, I believe not; I do not think we had any trouble in selling them. What I can say is that when the samples arrived in the laboratory they were in as good a condition as the other samples which had a preservative in.

5697. Do you infer then that there is no absolute necessity to put a preservative even in Australian butters?—I should infer it from that fact.

5698. Has there been a tendency of late to reduce the quantity in Australian butters?—Yes, there has.

5699. How do you think that tendency has come about?—I am afraid I have not any information how it has come about. I should think though that they had found that the quantity that they put in was larger than was necessary; that is to say, I think that they had been in the habit of putting in 1 per cent. for some years, and they found without making any appreciable difference they

Mr. H. D. Richmond and Mr. I. A. Hattersley.

22 Jan. 1900.

could reduce that to about half a per cent; consequently it was done so.

5700. So far as you know there has been no improvement in the mode of carriage or in the method of manufacture, which would account for the change?—I cannot say that—I do not know.

5701. So far as you know there has been no change in that respect?—So far as I know there has been none.

5702. Now the preservatives that you have named to us are comparatively easy to detect qualitatively?—Yes.

5703. Is their quantitative determination equally easy?—In the case of boric acid and salicylic acid they can be estimated with ease and accuracy. In the case of formaldehyde at the present time it cannot be estimated quantitatively. The reason for that I may add is that, as I have mentioned before, formaldehyde combines with the proteids of the milk, and when it has combined it cannot be separated in the same way that it could be if it had not combined.

5704. You mean that the formaldehyde enters by combination into the casein?—Yes.

5705. And forms a chemical compound?—Yes.

5706. So that in time the evidence of formaldehyde would disappear?—Yes.

5707. Is there any change which would come over formaldehyde apart from its action on casein?—There is a change which might take place; it might undergo an oxidation to formic acid, and perhaps even to carbon dioxide, but I do not think that that takes place to any great extent.

5708. You mean in so dilute a solution?—Yes; in so dilute a solution I do not think it does take place to any great extent.

5709. Is not formaldehyde a substance liable to polymeric change?—Yes, it is.

5710. Would not therefore a sample of ordinary formaldehyde be liable to take a different shape by this polymeric change?—I hardly think so in the extremely dilute solutions in which it is used in milk. The strong solution, the 40 per cent. solution, which is sold commercially, undergoes this change with a fair amount of ease, and from that, on standing, a precipitate is formed, but I do not think that this takes place appreciably in extremely dilute solutions. Then I would also like to point out that, supposing it has taken place, it would be converted back into formaldehyde in the process of estimation, because to estimate it it has to be distilled over, and when the insoluble or the comparatively insoluble trioxymethylene is heated with water, it re-forms formaldehyde. Therefore, I think it would hardly be removed from this cause.

5711. But in any case it would be a matter of some difficulty to ascertain by quantitative analysis what had been the actual amount of formaldehyde which had been originally added?—Yes, it would at the present time.

5712. Also I presume if a person using formaldehyde as an antiseptic used the strong solution, that solution would be liable to change by transformation into polymeric modification?—Yes.

5713. So that the person using such an article would never know what strength of formaldehyde he was employing?—Yes, that is so.

5714. Now, I think you have made some experiments, have you not, upon the length of time that milk will keep at various temperatures under the inhibiting effect of these various preservatives?—Yes, I have.

5715. Perhaps you would kindly hand in the table showing that?—Yes. (*See App. No.* 31.)

5716. Turning our attention to the changes which come over butter, in what way does butter decompose in keeping?—It decomposes in three ways; first, by the action of micro-organisms on the buttermilk which is unavoidably left in; secondly, by the hydrolysis of the fat, owing to the action of the small quantity of water which is dissolved in it; and, thirdly, by the oxidation of the fat under the combined action of air and light.

5717. Now what have you got to say as to the different modes of decomposition?—I do not think that the first change which I have mentioned plays any important part in the change of butter.

5718. What do you say as to the second?—The second, I think, is the most important. It causes the butter to turn rancid; but that would be hindered by any salt which would dissolve in the water that is left in the butter, and would withdraw the water from the fat.

5719. In other words, I gather from your statement that there may be some connection between the keeping quality of the butter and the quantity of water with which it is admixed?—Yes, I think there might be some connection, but I do not think the connection would be very great, because the quantity of water which can be dissolved by butter fat is extremely small, and it bears an extremely small proportion to the quantity of water which is in butter.

5720. I was speaking not more particularly about the amount which is dissolved than about that with which it is associated; in other words, do you know of your own knowledge that there is any connection between the keeping quality of butter and the amount of water with which it is associated?—I think if the water is extremely high it has a tendency to keep less well than if the water is of the average amount.

5721. In other words, dry butters keep better than those which contain an undue quantity of water?—Yes, I think they keep a little better.

5722. Now, then, as to the third change?—The third change was the oxidation of the fat under the combined action of the air and light; that would not be affected at all by adding preservatives. That change causes butter to have a tallowy taste.

5723. Now of the three causes of decomposition that you have given to us, which do you think plays the leading part in determining the rancidity?—I think the second cause, undoubtedly.

5724. That is, the action of the admixed water?—Yes.

5725. And that, you say, can be prevented by a small quantity of salt?—Yes.

5726. (*Dr. Bulstrode.*) May we ask you questions as to the supply of the Aylesbury Dairy Company with milk, as to the extent of the trade and the sources from which you obtain the milk, or would you rather we asked those of Mr. Hattersley?—I could answer them, but I think Mr. Hattersley would answer them very much better. My duties to the Company are almost entirely confined to the control of the laboratory and so on. Mr. Hattersley will answer any questions referring to the trade.

5727. Mr. Hattersley will be able to tell us as to the methods adopted by the company for ensuring cleanliness, cooling, and so forth?—Yes.

5728. Could you give the Committee your views as to how long you think butter should keep for trade purposes, or is that another question you would refer to Mr. Hattersley?—I think that for the purpose of our trade, if the butter keeps good for at least a week, it is sufficient.

5729. I intended to say milk?—I think that if milk will keep sweet for 18 hours that would be sufficient for our trade—that is to say, we can supply milk and give ample time for its consumption within 18 hours.

5730. Do you think that would be a fair limit to take for the supply of the whole population—I mean rich and poor in all towns?—I think so.

5731. You do?—I do not see any reason at all why milk need be kept longer than that.

5732. Do you think, under the present conditions, that there is any difficulty in ensuring that milk shall be kept fresh that length of time without the use of preservatives?—No, I do not think there is any at all. I would like to draw your attention to some of the figures in the tables I have handed in. According to the determinations I have made at the temperature of 70 degrees Fahrenheit, milk would keep for 34 hours before it turns sour; at 80 degrees it will keep for 22 hours, and 90 degrees it will keep for 15 hours.

5733. Under what conditions, may I ask—the conditions of the laboratory, or where was the milk kept?—apart from temperature?—The milk in this case was kept in bottles in a chamber kept at this temperature. Then I would also like to say that I have some figures here which show the temperature of the milk on arrival at our dairy at Bayswater. Even in the hottest weather last summer the maximum temperature was only 77 degrees Fahrenheit. Now it is quite certain that that milk directly after it was milked was cooled down to a temperature below 77 degrees, and therefore the average temperature to the time from when it started to the time it arrived at our dairy was under 77 degrees. That (77 degrees) is the maximum temperature. The time taken in transit was perhaps 8 to 10 hours. Then the maximum temperature of milk that I have observed after it has left our dairy, has gone on a round, and has then been brought back to the dairy, has been 83 degrees Fahrenheit; therefore, I think that I should be perfectly safe in assuming that the average temperature throughout will not have been higher than 80 degrees. Under those circumstances we have found that we can supply milk and give three or four hours at least for the consumption after it reaches the consumer before anything is done to it, in which it will remain fresh.

5734. Three or four hours you put as the time which the consumer could keep it?—Yes, at least.

5735. On that basis do you have any complaints as to the milk turning sour?—We have complaints, and I think Mr. Hattersley has a list of the complaints.

5736. With regard to these Australian butters which you have found without preservatives, could you give us any idea of the number of samples which you found contained no preservatives?—Yes; I only found two samples containing no preservatives.

5737. Only two out of how many examined?—I have not had a very large number of Australian butters; perhaps out of twenty of them.

5738. (*Chairman.*) Were those two samples free from salt?—No, they contained salt.

5739. (*Dr. Bulstrode.*) How much salt?—This was not estimated in those cases, but I should say from the taste of the butter it was between one and two per cent. That is about the usual amount in Australian butter.

5740. Have you had any experience of butter which has been brought over from the colonies without preservatives and in a refrigerator; have you had any experience as to its keeping qualities when it is taken out of the refrigerator?—Except for those two samples, which I presume came in a refrigerator—I do not actually know that they came in a refrigerator, but I should say it is almost certain that they did—except for those two samples I have none.

5741. You think, I take it, that the difficulty in estimating quantitatively the amounts of preservatives in milk would be a difficulty against stating any maximum standard?—Yes, I think it would, because the quantitative estimation of small quantities of the preservatives in milk first of all is not very exact, especially if one takes into consideration the fact that it may not be evenly mixed. Then also it would cost more; the fee which would have to be paid to the analyst if he was required to make a quantitative estimation would certainly not be less than the fee which is now paid under the Sale of Food and Drugs Act. I think that if he was simply required to test for it, and had a large number of samples, it might be done for a smaller fee, and, therefore, a much larger number of samples could be analysed.

5742. You say in your synopsis that boric acid is the weakest preservative, and appears only to hinder the growth of micro-organisms, but that formaldehyde is a very strong preservative inimical to the action of micro-organisms. Have you done experiments with one and another bacilli as to that?—No; the reason I had for making this statement was that I know that micro-organisms can be killed and fixed with formaldehyde solution, while with boric acid solution it would not be so.

5743. You regard boric acid more as an antiseptic than as a disinfectant, I think?—Yes, I should.

5744. And formaldehyde more as a disinfectant?—Yes.

5745. (*Dr. Tunnicliffe.*) With regard to the action of salicylic acid on enzymes, is your opinion on that subject based upon what you have read or upon what you have done; you say that salicylic acid has an action on enzymes?—I think it is chiefly based upon what I have read. I have also found that the action of certain enzymes, diastase for instance, is stopped by salicylic acid.

5746. That you have found yourself?—Yes.

5747. With regard to your view of the difference between boric acid, formic aldehyde, and salicylic acid, do you not think the difference is one rather of degree than of kind, or would you say it is a difference of kind?—I think that in a dilute solution it is a difference of degree; it is only when one comes to a strong solution that it is a difference of kind.

5748. All those solutions you have mentioned that are used for fixing micro-organisms in formic aldehyde would be relatively stronger?—Yes.

5749. Have you found fluorides at all frequently as preservatives?—No, I have not; in fact, I have not found them at all myself.

Mr. H. D. Richmond
and
Mr. J. A. Hattersley.

22 Jan. 1900.

5750. Do you know anything about the action of fluorides as preservatives that you can tell the Committee—I mean secondhand?—I have experimented with them. Some years ago I made some experiments on the action of various preservatives on the keeping of milk samples. In those cases I added far larger amounts of preservatives than would be added for trade purposes. I found that the most perfect preservative was hydrofluoric acid. I have also since then experimented with fluo-boric acid, and I have found that to be an extremely strong preservative.

5751. Would you be kind enough to hand in the result of your experiments on fluorides so far as you know them?—I have not got the experiments with me, but I could send them on.

5752. Thank you, if you would do that?—Yes, I will. I would like to make it perfectly clear that my experiments were not made on the keeping of milk for consumption, but simply for the keeping of samples for analysis at a later date. (*See App. No.* 32.)

5753. (*Chairman.*) I understand that you have said something about the proposal to limit the proportion of the quantity of preservative used, and you have expressed your opinion that that would be inoperative?—Yes, I think so.

5754. Either prohibition or nothing is your view?—Yes, I think so. There are several reasons for that. The first is that preservatives come into the hands of a dairyman not as boric acid and formaldehyde, but under some fancy name; and the dairyman, unless he has had special information on the point, would not know what he is using, or the quantity of the active ingredient in his preservative, and therefore he has to make an assumption there. Then also, as I have mentioned, I think that the quantitative estimations of small quantities of preservatives is not very accurate, and the cost of that is comparatively high; and therefore the enforcement of any legislation would be rather expensive. Last of all the stated quantities of the preservative might be put in by several people; for instance, in the case of milk there might be the farmer, there might be the wholesale dealer, and there might be the retail dealer; each of those might add a quantity of the preservative within the limits prescribed, and he might send it on to the next person, who would also add a quantity within the limits prescribed, and each person might receive from the other the produce with a warranty; so that no one of them would have added more than the quantity allowed, but the total amount would be above it.

5755. (*Dr. Tunnicliffe.*) I take it from your short *resumé* of the action of preservatives on butter that you think the action described by you under (a) of your list is the chief action which would be effected by preservatives?—Yes.

5756. And that would be a chemical action or a chemico-biological action?—Yes.

5757. Whereas the other is a purely physical action?—Yes.

5758. And would be effected by any substance having the power of removing water?—Yes.

5759. (*Chairman.*) We should like to hear anything that you have to say on colouring matters?—The only colouring matter employed by us is annatto. That I might say is derived from the pulp of the fruit of bixa orellana, and is added in the form of an extract of that in sodium carbonate. This extract, according to an analysis that I have made, contains about 15 per cent. of total solids, about 7 per cent. of sodium carbonate, and about 2 per cent. of the actual colouring matter which is present, and which is known as bixin. I calculated from those figures that 100 parts of the commercial extract are equal to about 10 per cent. of the commercial colouring matter. The quantity added is about one part to 30,000 of the commercial extract, which is equal to one part to 300,000 of the commercial colouring matter and one part to 1,500,000 of the actual pure colouring matter.

5760. Other colouring matters are taking the place of annatto in the trade, are they not?—Yes, they are being used. I have come across samples of extracts which have contained aniline colours. The colouring matter which the tests I have employed indicate is a sodium dimethyl-amido-azo-benzene-sulphonate, which goes by the name of methyl orange; but I think in some cases the colouring matter employed is a mixture of annatto and an aniline colour.

5761. I suppose Mr. Hattersley will tell us why it is used?—Yes.

Mr. H. D. Richmond and Mr. I. A. Hattersley.

22 Jan. 1900.

5762. (*Dr. Tunnicliffe*). Then I take it from what you say, you wish to standardise butter with regard to its colour in a very definite manner; you standardise it, you say, to a colour equal to that given in butter from milk from cows fed on grass under the most favourable conditions?—Yes.

5763. I suppose the quantity of these aniline colouring matters that is contained in butters is exceedingly small?—Yes, it would be extremely small.

5764. Could you give the Committee some idea of the amount, roughly?—The quantity of commercial colouring matter which is added to butter, which, I may say, is usually added in a solution in oil, either cotton-seed oil or other oil, is about, on an average, one part of commercial colouring to 1,000 of butter, and I think that if an aniline colour is used that corresponds to about one part per 100,000.

5765. Have you had any experience of any derivatives of picric acid being used as colouring matters?—No, I have not.

5766. (*Chairman.*) (*To Mr. Hattersley.*) You are Managing Director of the Aylesbury Dairy Company, I believe?—Yes.

5767. May I ask if you have been long connected with the Company?—Nearly twenty-one years.

5768. Could you give us a short sketch of the sources from which you derive your supply, and their distances from London, and your area of distribution?—Yes. We derive the greater part of our supplies from Berkshire and Wiltshire, but we also get milk from as far as Cheshire. We deal, I should say, with about 6,000 a day.

5669. Do you get new milk from Cheshire?—Yes, twice a day.

5770. Could you tell us the most distant point in miles?—I think about 200 miles; it is near Beeston Castle, on the Tarporley Estate. That milk is really what we call accommodation milk; we do not have it in the summer time unless we particularly require it during the height of the season, though we may have some of it all the year round, but naturally we prefer a short distance milk to a long distance milk. At the same time the Cheshire milk arrives in London in a very satisfactory condition.

5771. And entirely without the use of preservatives?—Entirely.

5772. Has that always been the practice of your company?—It has always been the practice. I am speaking now of 21 years from my own knowledge and of the previous 10 or 12 years of the company, from what I have been told.

5773. What was the reason for that policy?—Because we did not think it was necessary.

5774. And not from any idea that it was hurtful?—No.

5775. Or from any action on the part of your customers?—No, not at all. It has all along been considered quite unnecessary for milk that is to be consumed in London to be preserved in any way whatever. I think one idea in the mind of my predecessor was that if it became general for milk to be preserved it would rather be against the English farmer, as it would allow foreign milk to be imported. I think that was primarily his idea.

5776. Do you stipulate for any process on the part of those who supply you?—Yes. I do not wish to inundate the Committee with a great many documents, but if I may I will put in a copy of our agreement with the farmers. (*Handing in print.*) Before I go on with that may I say that during 1899 we had only 78 letters of complaint about sour milk, from at least 5,216,580 deliveries, from our chief office alone.

5777. Your deliveries?—Yes, reckoning twice a day. I have not got that out exactly, but I have taken that as an estimate. I know it is more than that. The actual letters that we have received from our customers complaining of sour milk were 78 only. I think that will show the Committee more than anything that I can say that we have given satisfaction to our customers.

5778. Do you find any difficulty with the railway companies?—In what way?

5779. In exposing milk to contamination or delay?—No. They might be a little better than they are, but the only cases of contamination that I can think of now will be that sometimes they send up the milk in a fish wagon. Those cases are very few and far between. The fact of the milk being sent up in a fish truck would affect the milk.

5780. It would affect the flavour of the milk, would it?—It would affect the flavour and the smell of the milk. I remember a case three or four months ago, during last summer, at all events, where the milk came up in a guard's van, and there was some fish in there, too; that affected the flavour of the milk, and there were complaints from our customers. Taking it as a rule I think we are fairly served by the railway companies.

5781. I see that one of your conditions is that all milk is to be thoroughly cooled immediately after milking over a refrigerator?—Yes.

5782. I suppose that is essential to its keeping?—Yes. I do not think we should be able to have milk properly sent up to London unless it were cooled.

5783. Have you any experience of pasteurised milk?—The demand for pasteurised milk is very small.

5784. Is it increasing?—The sale for sterilised milk is increasing, but not for pasteurised milk.

5785. How do you discriminate between pasteurised and sterilised milk?—It is pasteurised we say when it is heated up to about 160 degrees Fahrenheit, and it is sterilised milk when it is heated up to about 212 degrees. That is what I am told, but I am not a scientific man, and I do not know. That would be it, would it not, Mr. Richmond. (*Mr. Richmond.*) Yes.

5786. (*Professor Thorpe, to Mr. Hattersley.*) Do you sterilise it yourself?—Yes, we sterilise the milk in London. We have a fairly large trade in that. It is all sold in bottles. It is sterilised in bottles, fitted with a lid that closes automatically in the steam chamber. It is sterilised by steam. One great point that we make is that the milk is to be sent up to London twice a day. You will see that condition in paragraphs 1, 13, and 14 of our agreement with the farmers, whereas it is not the universal practice to send up milk twice a day to London. Another point, if I may mention it, is that, although we put the onus upon the shoulders of the farmer to see that his churns are clean when he sends the milk up to London, we invariably wash the churns out, and steam them, because unless that is done the churns will reach the farmer in a stinking condition, especially in the summer time, and it is impossible for him to supply a sweet milk to London if the churns are not thoroughly cleansed immediately after they are emptied in London. I think that is one very great point.

5787. Now, as to your supply of cream: Is the cream sent up from the country?—No, with the exception of one small lot of cream, which we obtain from Sussex, a few miles out of London—about 20 or 30 miles out—but that is quite an exceptional case.

5788. It all comes in the milk, and it is treated by your separators?—Yes, it is treated with our separators at Bayswater.

5789. Do you use any preservative in the cream?—No.

5790. Do you find any difficulty in distributing it?—No. In 1899 we had six letters of complaint, and those letters average about 0·05 per thousand quarts. The total number of complaints that we had (that is including verbal complaints sent through the milk carriers, which are not to be taken very much notice of) throughout the year 1899 was 0·58 per thousand quarts, and as I have said, the actual letters we received were 0·05 per thousand quarts of cream.

5791. Is clotted cream treated with preservatives?—No.

5792. Do you manufacture that on your premises?—Yes.

5793. From your knowledge of the nature of clotted cream would you say that there is much difficulty in bringing it up from Devonshire to London?—No. Formerly—I am speaking now of about fifteen years ago—Mr. Coryton, of Pentillie Castle, supplied us with our clotted cream, and we never had any trouble.

5794. Clotted cream keeps rather longer than ordinary cream, does it not?—Yes, because it is scalded.

5795. Which means that it has been sterilised?—Yes.

5796. Do you employ a preservative in the butter churned by the company?—No.

5797. But you do handle other butters which contain preservatives?—Yes; the imported French butters contain a preservative, but all the butter that we make in our own dairies contains no preservatives at all.

5798. I should like your opinion on this point. It has been represented to us that the French butter is perfectly fresh without any salt, and is of a higher quality than the Danish butter, which contains about one per cent. of salt; is it your opinion that the use of preservatives is necessary to the French butter trade?—Of course I only know about the French butter from hearsay, I know nothing personally of how the trade is done in France, but as I understand it is made by small farmers collected at different stations, and then sorted out into different qualities.

5799. In a factory?—Yes. They must do something with it then, as it must be several days old, and it is necessary to put something in to keep it.

5800. You would not undertake from your knowledge of the dairy business to collect butter in Normandy, and supply it fresh to London without any preservatives at all?—Or without salt, and then of course it would not command such a high price, because it would be salt butter.

5801. You think it would not be possible?—I should say not from what I have heard of the system of collecting French butter.

5802. Now, I should like to ask you a question or two about colouring matters. Mr. Richmond has told us that you do use them to some extent; could you tell us how you use them, and why you use them?—The reason we use them is to preserve continuity of colour all the year round, the lack of which would interfere with our trade. I have tried several times to do away with the use of colouring matter, and I should be delighted if it could be done away with.

5803. But your customers will not be satisfied without it?—They will not. We have used very little in the summer time when milk is rich-looking, and in fact it is then practically knocked off altogether.

5804. The object being to give a uniform rich appearance to the milk?—Yes.

5805. And with butter the same, I suppose?—Yes, it is used for exactly the same purpose.

5806. Does your company deal with margarine at all?—No.

5807. Are you aware that margarine is extensively coloured to resemble butter?—That is what I have read, but I do not know anything personally about margarine.

5808. If you will take it from me that it is so coloured have you any opinion to offer as to the merits of such a practice; do you, as a manufacturer of dairy substances, have any opinion as to whether margarine ought, or ought not, to be coloured to resemble butter?—It is not coloured to resemble butter; it is coloured to resemble butter which is coloured. I suppose that if the law were against the colouring of butter they would not colour margarine.

5809. Margarine is naturally as white as that paper, is it not?—Yes, and butter in the winter time would be so, or very nearly so.

5810. From certain cows butter is nearly white?—Yes.

5811. But not so white as margarine?—That is so.

5812. I think one may assume that the intention of colouring margarine is to make it resemble butter?—There is no doubt about that.

5813. Have you any opinion upon that practice; is it an honest one or desirable one?—No, I do not think it is.

5814. But you have not found it interfere with your trade?—No, not at all.

5815. Then I understand you would advocate the prohibition of colouring matter in dairy produce, and leave customers to colour it to their own fancy?—I do not know what to say about butter. I should say with regard to milk that it would be a great deal better not to colour it.

5816. Does your company manufacture cheese?—No, except cream cheeses.

5817. You have no opinion to offer, then, as to the colour of cheese?—No, I have not.

5818. (*Dr. Bulstrode.*) Could you tell us exactly what steps are taken and insisted upon by the Aylesbury Dairy Company from the time when the cow is about to be milked to the time when the milk is received by the consumer, just briefly, so as to bring out the several precautions that you take?—Shall we commence a little before the cows are milked?

5819. Yes, by all means?—In the 11th paragraph of our agreement with the farmers we say: "No milk to be sent from any cow that is not in good health, or that is under physic. (12) No milk to be sent from a newly calved cow, or from a newly purchased cow until she shall have been in the possession of the sender one clear day; or from any cow whose calf has been removed, for the space of one clear day after removal. (22) Attention to be paid to the cleanliness of the cows' udders and the hands of the milkers," and 15 and 16 that "milk is to be properly strained and cooled immediately after milking over a refrigerator."

Mr. H. D. Richmond and Mr. I. A. Hattersley.

22 Jan. 1900.

5820. As I understand, you have no further regulations than that formal statement, in which you say that attention is to be paid to the cleanliness of the hands of the milkers, and of the teats of the cow?—We cannot personally, nor can our officers, see to the hands of the milkers, but our veterinary inspectors go round at least once a month to the farms, and they are instructed to report to us if the cows' udders are not in a clean state. They do not go at any appointed time, but when they like, and they can go two or three times a month if they like. If we hear from our veterinary surgeons that the cows are not kept in a clean state the farmer is written to at once.

5821. We have now got to the straining of the milk?—Yes; then the milk is passed over a refrigerator.

5822. Would you kindly define what you mean by a refrigerator?—The refrigerator is a thin copper vessel, through which water runs, and the milk is poured over the top of this, and runs down the outside of it.

5823. It is more correctly a cooler?—Yes, it is.

5824. A refrigerator is apt perhaps to convey a wrong idea?—Yes, it is more correctly a milk cooler. After the milk is run over this cooler it is put into the railway churns; the railway churns are sealed.

5825. Are they all sealed?—They are all sealed.

5826. Are there none sent away without being properly sealed?—If any churn comes up to London without a seal the milk is not sold by us as milk; it is churned into butter, and the farmer is paid a lower price. So he is fined really to ensure more care in future. Our reason for not selling milk that comes in a churn which is not sealed is that we do not know how much milk has been taken out, and how much water has been put in.

5827. Or what else may have been put in by any mischievous person?—No. With regard to our water supply we are always very particular about that to see that we get a really good water supply.

5828. On your several farms?—On our several farms.

5829. (*Chairman.*) You say on your several farms, does that means farms in your possession, on farms supplying you?—Farms supplying us. I may say that the majority of our farms have supplied us for over twenty years. Every farm before we take any milk from it is inspected by the medical officer of health for the district, and he makes a report on that form. (*Handing in a form.*)

5830. (*Dr. Bulstrode.*) Perhaps you would not mind telling us quite briefly the heads of it, so that we may get it on the notes?—The source of the water supply and the particulars about it, the levels of the source; the possibility of contamination; if a well, the depth of it, and the distance of the water below the surface; the material of the sides of the well; the fields in the vicinity, whether dressed with fertilizers; how the water is conveyed to the dairy; from what geological formation the supply is derived, and the medical officer's impression as to the cleanliness of the water supply, and any other points to which he considers it desirable to call attention. Then, under the head of sanitation, he replies to several questions about the farmhouse being in a suitable position, and about the refrigerator. We always insist upon the copper which is used for boiling water not being used for any domestic or household purpose, but only used for dairy purposes; he also reports on drainage, the health of the household, of the farmhouse, and the farm labourers; and then there are some general remarks.

5831. With regard to the amount of the water, and as to the risks of the water supply running short, we have had a good lot of evidence?—We have not found it; I think there was only one case where the water supply ran short, this last summer, and it was rather a hot summer. That was a public water supply.

5832. In the 78 complaints which you had last year, did you go to the extent of ascertaining if possible what was

Mr. H. D. Richmond and Mr. I. A. Hattersley.

22 Jan. 1900.

the cause of the decomposition of the milk in those cases?—I should say that the majority of those cases arose from the improper treatment of the milk after delivery; but in one case we traced it to the milk from one farm not being properly cooled.

5833. In one case?—Yes, in one case only.

5834. In one house where a complaint came from you traced the source of the mischief back to a farm?—No, it was a general complaint. We had several complaints; it was on one day, and we had complaints from several customers supplied with the same milk. That was the only general complaint that we had during 1899.

5835. As I understand, you think it would not be possible to send any fresh butter from Normandy without these preservatives?—Yes, I do.

5836. (*Chairman.*) You mean not through factories?—Not through the present system. If there were a factory which separated its cream and churned it after properly ripening, there would be no difficulty at all. We have kept butter in our dairies for a fortnight without ice.

5837. (*Dr. Bulstrode.*) Is the demand for absolutely fresh butter increasing or diminishing, do you think?—It is increasing according to our own sales.

5838. For absolutely fresh butter the demand is increasing?—Yes. Our sales of fresh butter between 1895 and 1899 doubled; our sales of salt butter between 1895 and 1899 decreased.

5839. Could you offer any explanation of that?—No.

5840. There is no question of a richer class of customers being supplied?—No, I think not.

5841. (*Professor Thorpe.*) Can you tell us even approximately the volume of milk you deal with?—Yes, 1,500,000 gallons roughly, exclusive of that used for the production of cream and other products.

5842. When?—In the year.

5843. A million and a half gallons per annum?—Yes.

5844. May I ask you approximately from how many farms that volume of milk comes—I think you may take it at 50.

5845. The average distance of those farms is about 70 to 80 miles I understand?—Yes.

5846. There are some, however, as far away as 200 miles?—Yes.

5847. Even in the summer time?—Yes.

5848. Could you also approximately tell the Committee how many families you supply?—Speaking from memory I should say about 14,000.

5849. I suppose we could take five persons to a family?—I should think our families averaged more than five, because we have so many West End customers.

5850. You mean including the servants and all, of course?—Yes.

5851. What should you say would be the fair number in a family in your district?—I could not say.

5852. But it would be more than five?—I should think it would be more than five; there are very few West-End houses where there are less than five.

5853. Do you think you supply 100,000 persons a day with milk?—I should say so.

5854. Of late, I presume, cream has more and more got into the hands of grocers?—Yes.

5855. I presume it is the possibility of the use of preservatives which has led to the grocers taking up the trade in cream?—Yes, entirely.

5856. Entirely?—Yes, I believe until the potted cream trade arose grocers did not sell cream at all.

5857. Would you think it expedient, or would you see any difficulty in order to arrive at what you yourself think is desirable, namely, the disuse of colouring matter in milk in making an announcement on your own invoices, or in any other way you like: "This milk is not artificially coloured." Would that not suit your purpose?—An invoice, as I gather, is a document which goes with the goods; we do not deliver an invoice with our milk.

5858. I rather imagined that. I also qualified it or added to it by saying, "in some other way"; supposing you put it, for example, on your carts or on your cans, or in some other way let it be known that your milk was not artificially coloured, would that not be a satisfactory answer to your customers who complained against the milk that its colour was poor?—No, I do not think it would.

5859. Why not?—Because they like the rich-looking milk, and if they can get it elsewhere they go elsewhere.

5860. But not if they knew that that richness is really got by the addition of a small quantity of colouring matter; not if they are gradually educated to that extent?—I should like them to be educated first.

5861. But you are in respect to preservatives in so strong a position that you have at all events educated your clients by the notoriety, if I may say so, that you gained by not requiring the use of preservatives, that I thought you might go a step further in the educative process, and tell them that you also do not colour the milk?—I should be only too delighted if I thought it would work, but I have tried it so many times that I am disheartened. I have tried it year after year, and as soon as the colouring is discontinued a great many complaints come in from customers.

5862. (*Chairman.*) After the milk has been artificially coloured and the cream rises in it, does the cream in rising carry the colouring to the top?—I think so, but Mr. Richmond might be able to answer that better than I.

(*To Mr Droop Richmond.*) Do you find the cream carries it to the top?—(*Mr. Droop Richmond.*) No, I find that the colouring matter remains behind in the skim milk, and does not rise so much in the cream. With milk that has a high colour naturally, the colour comes up with the cream, that is, the colour lies chiefly in the cream, and the cream is more highly coloured than the other portion.

5863. (*Dr. Tunnicliffe.*) That is naturally so?—Yes.

5864. (*Chairman.*) But it is not so with the artificial colouring?—The artificial colouring remains behind to a large extent. There is not a great deal of difference in the colour between the cream and the skim milk, but, if anything, there is rather less in the cream than there is in the skim milk.

5865. Are you now speaking of artificially coloured milk?—Yes.

5866. (*Professor Thorpe.* (*To Mr. Hattersley.*) With respect to that question about the colouring matter, may I ask whether probably the great bulk of your complaints when you disused the colouring matter in the milk did not really come from the servants—the cooks and the persons who took in the milk—rather than from the persons who used it?—That I could not say.

5867. Have you had any written complaints about the disuse of the colouring matter?—It is some time now, and I could not carry my memory back far enough to answer you.

5868. Of course, it is quite conceivable that your persons delivering the milk might receive complaints from the cooks or the servants who took it in, which might be transmitted to you in the manner you have indicated?—Yes.

5869. I was curious to know whether you had had a formal written complaint from a householder complaining of the poverty of the milk because the colour was absent?—Mr. Richmond has had several samples of complaints he says; perhaps he might be allowed to answer that?

5870. Certainly?—(*Mr. Droop Richmond.*) When the colouring matter has been discontinued in the milk I have had several samples returned to the laboratory with complaints of the milk being "poor," or "inferior," or "adulterated," or some word expressing the customer's strong disapproval of it. In the large number of those cases, if not in all—I cannot say from memory how many—I have found that the milk has been, from a chemical point of view, of excellent quality; the complaint was apparently entirely due to the lack of colouring matter.

5871. I should imagine—I do not know, for, of course, this is a surmise—that the complaint has really arisen from a sudden change in the appearance of the milk of which the customer has not been made aware, and he has been suspicious from that circumstance; is it not so?—I can hardly say that—like you, I can only make a surmise.

5872. (*Dr. Bulstrode.*) (*To Mr. Hattersley.*) I take it from what you have said that the complaints in the case of cream are very much more frequent than the complaints in the case of milk?—No.

5873. I mean relatively?—No, I think not.

Mr. H. D. Richmond and Mr. I. A. Hattersley.

22 Jan. 1900.

5874. I should be glad to be corrected upon that point?—Unfortunately I am not able to give you the same statistics with regard to cream as I can with regard to milk. I gave you with regard to milk the number of complaints per thousand deliveries of milk.

5875. In the case of milk, you gave the deliveries as five million, and you said there were 78 complaints in the five million; is that not so?—Yes, that is it.

5876. In the case of cream, what was the rate?—The figure I gave there was not per deliveries; it was per thousand quarts of cream. I cannot, unfortunately, without a great deal of trouble, get out the number of deliveries of cream.

5877. So the two rates are not strictly comparable?—No, I tried to get some comparable figures, but I could not.

5878. Nevertheless, from a sort of general idea, you think the complaints in regard to cream are not so frequent as those in regard to milk?—I think not.

5879. How long do you think the average customer requires his milk to keep after delivery? The reason I ask you is because you have had complaints, therefore you know probably?—So far as I can see I should not say above five or six hours after delivery; some people however, want to keep it in the bedroom all night without taking any precautions, and expect it to be sweet next morning. We have had cases of that kind; a lady complained that she had kept the milk in her bedroom by her bedside over a lighted lamp, and it was sour next morning. Apart from such extraordinary cases as this, I think that no one requires milk after seven or eight o'clock at night.

5880. Invalids do, of course?—Then they would scald it immediately after delivery to ensure its keeping all through the night. You can have the afternoon delivery as late as five o'clock, the morning delivery as late as eight or nine o'clock, and then there is the midday delivery.

5881. In short, the length of time the milk keeps, of course, all depends on the way the milk is treated after it gets into the house?—Yes, after it gets into the house.

5882. May I ask you how long this form of contract which you have handed in has been in existence?—Speaking from my own knowledge, although it has been amended from time to time, practically in its present form I have known it for 21 years.

5883. Then these restrictions with regard to adding anything to the milk, and with regard to straining the milk, have been in force for 21 years?—Yes, those particular clauses have not been altered. The clause with regard to the water supply has been strengthened within the last 10 years.

5884. (*Chairman.*) Have you practised delivery in bottles in London?—The ordinary milk?

5885. Any milk?—Yes. Sterilised milk is delivered in bottles, and some of the ordinary milk, nursery milk, is delivered in bottles.

5886. But the general supply is in open cans?—The general supply is.

5887. Is there any objection to delivering in bottles?—The expense.

5888. The expense of the bottles?—Yes. It would be a very great expense to deliver in bottles.

5889. There are large towns, are there not, where the supply is entirely conducted in bottles?—Yes, Paris, for instance; and they get about 6d. a quart for the milk, I believe, there.

5890. And Copenhagen?—No, not altogether; they send out the milk in cans there.

5891. At Copenhagen?—They put up a great deal of milk in bottles, I know, nursery milk, the same as we do here; but milk is delivered in Copenhagen in open cans; they are small cans about so high and about that square (*illustrating*).

5892. Are those delivered to the consumer?—The cans are put in a cart with a small hole through the side of the cart, the same as here in England, and the milk is drawn off by means of a tap.

5893. (*Dr. Tunnicliffe.*) By nursery milk, do you mean humanised milk?—No, ordinary milk in sealed cans from a special farm.

5894. (*Professor Thorpe.*) You have told us approximately how many persons you supply, would you kindly add to that the area over which those persons are scattered approximately?—Muswell Hill on the north, Hanwell on the west, the Children's Hospital, Shadwell, on the east; I cannot tell you exactly on the south, but somewhere near Balham.

5895. Is that all served from Bayswater?—No, the area served from Bayswater has been restricted lately on account of our want of space. We should prefer to serve it all from Bayswater. However, our premises are rather restricted there, and we have had to open a depot in the north and one at Ealing, and one at Brompton; but we deliver from Bayswater to Shadwell, to Balham, and to Golder's Green—I think those would be the outside areas.

5896. Does the main portion of your milk come into London by Paddington?—Yes.

5897. Do you collect it from any other railway stations?—From Euston—Euston and Paddington are the only two. I may say that even the milk that is delivered at Muswell Hill comes to Bayswater first, and is tested there before it goes to our sub-depôt in the north of London to be re-distributed.

5898. (*Dr. Bulstrode.*) Have you on your books many poor people; I suppose your business is not entirely confined to what we call the well-to-do?—No; there are many what we should term halfpenny customers.

5899. So that the conditions which you have mentioned as necessary for the keeping of milk can be found in the homes of the poor?—Yes. I beg to hand in the forms of our medical officer's monthly report, and of the veterinary surgeon's monthly report. We think that these visits of the medical officers and of the veterinary surgeons have a great deal to do with the cleanliness of our supplies, and therefore with the milk keeping so well. I beg also to hand in these returns relating to the water supply. I may say that we inspected fifteen farms in 1899 for fresh supplies; we passed two farms without alteration, seven we passed after alteration and six we absolutely condemned. These reports are the particulars of the six that we condemned.

5900. (*Professor Thorpe.*) Do you put all those in?—I will put in the blank forms, if I may. (*Handing in forms.*)

Dr. Auguste Dupré, called; and Examined.

Dr. A. Dupré.

5901. (*Chairman.*) You are a Doctor of Philosophy, I believe, a Fellow of the Royal Society, and a Fellow of the Institute of Chemistry?—Yes, and Public Analyst for St. Margaret and St. John, Westminster, for 27 years.

5902. You have made some examinations, I think, upon the use of preservatives in milk?—I cannot say that I have paid much attention to the subject; it has not come before me officially at all.

5903. Have you got any observations to make upon the subject?—The only observation that I should like to make would be that first of all I object, generally speaking, to preservatives, because their use does away with the guarantee of cleanliness. If you get a milk that keeps you may take it that the dairyman has been a cleanly man and a careful man; if it does not keep the man may have been dirty, and by the aid of preservatives the dirty man can put his milk on an equality with the clean man's milk in regard to keeping qualities. I lose all guarantee of cleanliness as soon as preservatives are used. That is the chief objection I have against them, irrespective of their being wholesome or unwholesome. I think the question of their wholesomeness is a difficult point. There is a great difference of opinion about that. Some people think boracic acid very injurious; others do not think so at all, and therefore I have not paid much attention to it from that point of view. I think the practice of adding preservatives is highly objectionable on principle.

5904. You think it objectionable that a chemical substance, not a neutral substance, should be mixed indiscriminately with food unknown to the consumer?—Quite so.

5905. And before people have been able to agree as to what the exact effect of that substance is upon food?—

Dr. A. Dupré.

22 Jan. 1900.

I think it is objectionable, irrespective of the effect. I do not care if it has no effect at all on the consumer, or whether it has an effect, my objection being that I lose the guarantee of the general public: lose the guarantee of having a good milk if a preservative is added. If milk were frequently examined we might perhaps permit the use of preservatives; but take my own district, I do not suppose that a dairyman in my district is visited more than once or twice a year, and such an inspection as that cannot be a very great guarantee to the public of the purity of the milk. Everyone knows whether his milk keeps or not, and no family would buy milk from a dairyman whose milk habitually turned sour. That fact, which is constantly observed, is a great guarantee that the dairy is properly conducted, and on that ground chiefly I object to any preservative being added, because it takes away that general guarantee.

5906. What do you say about preservatives in other foods?—There are very few foods so extensively used. Milk is so important, because it is the only food of infants, and of invalids; therefore it is very important that milk should be really good. It is consumed in pretty large quantities, too; other foods are not consumed in such great quantities. Butter, for example, which now contains boric acid very generally, contains it in such small amounts and rancid butter is so objectionable, generally speaking, that I do not think there is much objection in adding a preservative to a food which is not taken as a sole food, which is not taken by infants, and where the quality is not of such great importance.

5907. Are you aware that preservatives are very largely used in fish?—Yes, from hearsay, but I never get fish to analyse, and I do not know it from personal experience; I only know it from general knowledge.

5908. Would you think it important that they should be used in fish?—No. I would have the same objection in the case of fish as I have in the case of milk. I regard the freshness of the fish as a guarantee of its having been recently caught.

5909. Are you aware that fish taken in the North Sea are washed with formalin and kept for many days, and even weeks, before being brought to the market?—No, I did not know that.

5910. If that were proved to be the case, would you think it desirable or necessary?—I should think it in the highest degree undesirable.

5911. Have you never experienced a hard sole?—Yes, I have certainly, but I never attributed it to its being kept in that way.

5912. You did not attribute that to the use of formalin?—No. I have never had any fish examined chemically.

5913. Have you any observations to make as regards colouring matters?—I have just put down a few points. Of course, no colouring matter that is considered in the ordinary acceptation of the term a poison should be employed.

5914. Not in any quantity?—Not in any quantity whatever.

5915. Would you permit the use of copper for colouring peas?—I should not.

5916. Are you aware that it is practically universal in the trade?—At one time, about 20 years ago, you could get no peas in London coloured with copper; there had been several prosecutions, and it had been abandoned. It is now coming into use again very generally. That is chiefly because of a foolish fancy on the part of the public; the public do not like discoloured peas. In a great measure it is due to the fact that people do not like on their table a preserved food; they like it to look as if it was a fresh food. Just like the poor, who do not want to buy margarine; they want to buy butter, or they do not want their neighbours to know they are buying margarine. In the same way the public is foolish enough to insist on green peas, although they know that they cannot be green when they are preserved. I see no advantage whatever to be obtained by adding the copper.

5917. Would you advocate the prohibition of that particular colouring matter?—Certainly I would, although there are great differences of opinion with regard to its poisonous character. Nobody has, however, any doubt that a certain quantity of copper would be dangerous and poisonous to different persons; some persons are affected by quantities so minute that we may call it infinitesimal; others may take the same kind of thing in relatively large quantities without any effect. You never know where the food goes to, and therefore any colouring matter which is poisonous, in a small quantity even, I should prohibit on that ground, because you never know how it may affect somebody.

5918. Then you would classify colouring matters as harmless and as injurious?—Quite so.

5919. And you would prohibit the last and permit the first?—I would permit the first under certain conditions. I would not permit a poisonous colouring matter to be used in certain limited proportions; if the colouring matter used is poisonous I would prohibit it entirely.

5920. If the colouring matter is used in small quantities a quantitative analysis is very difficult, is it not?—In some cases it is very difficult. For instance, boracic acid in milk is not at all easy to estimate accurately. It would give rise to no end of discussion and difficulties. One analyst would find 30 grains, and another would say there are only 28 or 26 grains present.

5921. Would you be satisfied if the presence of these poisonous or injurious colouring matters was notified to the consumer on the label or package?—That assumes that the consumer knows that it is poisonous, unless you added "This is coloured with a poisonous colouring matter." Suppose anybody says it is coloured with copper. Many people would eat it without knowing that copper is poisonous. But I see no object gained in colouring matters.

5922. (*Dr. Tunnicliffe.*) May I ask if you think it probable that the amount of copper used now for preserving peas is actually injurious?—I cannot say from personal experience.

5923. I may tell you that one grain per pound, of which 40 per cent. alone is rendered soluble, is about the datum which you might have for basing an opinion?—I know that is about the quantity allowed; in some instances in New York they allow that amount.

5924. You cannot offer any opinion as to whether that would be injurious or not?—No.

5925. That would be half a grain of copper, assuming you ate a whole pound of peas?—I say, if I saw any good gained by it, it might perhaps be done. But I see no possible good; on the contrary, I see possible harm. I know some people are affected by quantities which are perfectly inoffensive to others.

5926. With regard to your second objection I think it was based upon idiosyncrasy?—Yes, it was.

5927. Now, is idiosyncrasy a very common thing with regard to the metallic poisons?—It is very common indeed.

5928. With regard to the metallic poisons?—Yes, it is indeed; with regard to lead, it is very common. Some people suffer from lead poisoning when they look at lead almost. Take towns that are supplied with lead water; hundreds of persons drink that water without being poisoned, and a dozen or so suffer severely; in one house one person suffers severely, but the others escape entirely. Go to any lead factory and you will find some workpeople work for years without ever suffering, but another poor fellow goes in, and the first week he is down with lead poisoning.

5929. And you would put that poisoning down to what we call idiosyncrasy?—Yes. I know several cases within my personal knowledge. I suffer from things that do not affect other people at all—quinine amongst them. I suffer severely from it.

5930. I was not doubting with regard to the alkaloids, I was more suggesting with regard to metals?—Lead is one of the things in which you will find very characteristic idiosyncrasies. I should say lead, chiefly, and arsenic, too.

5931. But you see no objection to colouring if some colour could be used which was not poisonous, even in any quantity?—I should see no objection at all in that case, if the public like it.

5932. But you think it incumbent upon the people who use the colour to show that it is not poisonous before they use it?—Yes.

5933. (*Professor Thorpe.*) The object of adding copper to the peas is to preserve them of a green colour?—Yes, to make them appear like fresh.

5934. To make a stale pea appear like a fresh pea?—Yes, quite so.

5935. Is that not rather of the nature of a fraud upon the purchaser or consumer of the pea?—It is scarcely a fraud, because everybody knows it.

Dr. A. Dupré.

22 Jan. 1900.

5936. Supposing I go into a restaurant and ask for fresh peas, how am I to tell that I do not get preserved peas coloured with copper?—I think you would tell if you looked at them. They never look quite the same; they shrivel up more, they are never the round, nice peas that are fresh. You can see if you look at them carefully, but in restaurants it may be a fraud, no doubt. I believe the chief reason is that people do not like on their table a preserved article when there are fresh ones obtainable, just like the poor; they do not like to buy margarine, and they do not like people to know they are buying margarine; in the same way people like green peas, but they do not like a preserved article on their table at a time when fresh peas are available. That is the chief reason, I think.

5937. I gather from you that you do not think a declaration on the tin or on the bottle that "these peas are coloured with copper" would be a sufficient precaution?—It would go a very great way I think as a precaution, although it may not be complete.

5938. Does your objection to the use of mineral colouring matters apply to other substances than copper, as, for example, the use of oxide of iron, which is not a particularly poisonous substance?—At present a dealer is allowed to sell cocoa mixed with starch and sugar, as long as he says it is a mixture. He need not say it contains only 20 per cent. or 30 per cent. of cocoa; if he says it is a mixture he is safe against the law. But nobody would buy a cocoa that contains only 30 per cent. of cocoa, and that chiefly contains starch and sugar, because it would be so colourless that they would at once see it was not cocoa; therefore, the vendors add iron, and so make it of the same colour, or nearly so, as cocoa, and people buy it for cocoa, not knowing that it contains only 20 or 30 per cent., being misled by the colour. I should prohibit it; that is a distinct fraud.

5939. A distinct fraud?—Yes, and the vendor cannot be got at, at present.

5940. That is a greater fraud than even the use of small quantities of poisonous copper in peas, is it not?—Yes, it is a greater fraud, but at present because he cannot be got at, because it is sold as a mixture. I have had several cases quite recently in my district of cocoa, some of it only containing 30 per cent. of cocoa, but coloured with iron, but there was not enough iron present to enable our medical officer to swear that it was injurious, and so no prosecution could be undertaken. The same with mustard. Mustard is very extensively mixed with starch, and then coloured with turmeric. It looks like pure mustard, but is only half of it mustard.

5941. That is a fraud in your opinion of the same nature as the addition of large quantities of oxide of iron?—Yes.

5942. (*Dr. Bulstrode.*) You referred to the use of preservatives as being unwholesome, quite apart from any evidence as to whether they may be injurious or not?—Quite so.

5943. That was by virtue of the fact that they may possibly veil want of cleanliness?—They certainly do, I know.

5944. They may be likely to do so?—They do so as a matter of fact; I know that they do that.

5945. What evidence would you bring forward that they actually have done that?—Because you have only to go into many shops where they sell the milk, and to see the condition in which they are. The milk is kept in the bedrooms of the people, or in the washhouses of the people, and there are all kinds of risks of dirtiness, and yet it keeps—because there is a preservative added.

5946. It would not keep under those conditions save for preservatives?—No, it would not.

5947. The effect of the uncleanliness is not obvious upon the milk, provided it is kept by preservatives, is it?—No, it is not.

Mr. JOHN MITCHELL HARRIS, called; and Examined.

Mr. J. M. Harris.

5948. (*Chairman.*) You are managing director of C. and T. Harris and Co., Limited, bacon curers, Calne?—Yes.

5949. And deputy chairman of the Bacon Curers' Association?—Yes.

5950. Your company has been established a number of years, I understand?—Yes, a good many—80 to 100, I dare say.

5951. You deal in Wiltshire bacon, I think?—Entirely; we do not deal in anything but our own curing.

5952. It is a well-known brand, is it not?—It is a well-known brand of Wiltshire bacon. We kill all the pigs ourselves.

5953. You kill all the pigs yourselves and cure on the premises?—Yes.

5954. Can you describe the process of cure carefully; what substances are used?—Simply salt and saltpetre.

5955. None of the modern preservatives?—No nothing at all in the shape of borax or any other chemical. We never have used anything but salt and saltpetre.

5956. Do you export?—Yes, largely.

5957. How do you pack your bacon?—In salt. We wrap the sides or the pieces of bacon as they are ordered from our customers in canvas after drying it; it has to be dried first.

5958. Is it cured green or mild?—Are you speaking of bacon for export now?

5959. Yes; I may tell you the object of my inquiry is that we have been told that borax and boracic compounds are so useful for packing bacon after it has been mildly cured?—The bacon we send abroad we put a little more salt to, and extra dry it. Then sew it in canvas, and pack it in dry salt in cases. That is for hot climates, like India and the Cape.

5960. Why do you prefer dry salt to borax?—We have never found occasion to use borax.

5961. But you know it is used largely?—I know it is used in the American and in the Canadian trade.

5962. If the borax did not get into the meat it could make no difference to the consumer?—If it did not get in it would make no difference, of course.

5963. Does the dry salt in which you pack it get in?—No, the canvas keeps it out.

5964. And it would keep the borax out, would it not?—I have no experience of packing bacon in borax.

5965. You are quite satisfied with your present method?—Yes.

5966. You do not deal in American bacon?—No, we have never had any of it at all on our premises.

5967. Do you know anything about the process of curing and packing in America?—I believe the American bacon is cured in the same way that we cure it, and have cured it for a great many years—that is, with salt and saltpetre; then, after it is cured mildly with salt and saltpetre, so that it may stand the voyage here, it is placed in a trough and borax sprinkled over it, back and front, and then put into the box, and comes to Europe. After that, when it gets here it is washed out.

5968. Have you ever tested or submitted any of that bacon to analysis?—Yes, for our own information. Some short time ago we put a side of our own bacon that we had cured in the ordinary way into borax, or rather sprinkled it with borax, left it there for eight days in our own cellar, then we washed it thoroughly, and put it into one of the drying houses. After it was dried we cut the gammon part off and sent it to the secretary of the Bacon Curers' Association, with a request that he would send it to an independent analyst, which he did. Another firm of Wiltshire bacon curers, Messrs. Oake Woods and Co., of Gillingham, did the same thing in exactly the same way, and also sent their gammon to the secretary of the Bacon Curers' Association, Mr. Stewart. At the same time Mr. Stewart bought a gammon from, I think, Spiers and Pond, in Queen Victoria Street, of Davies's pea-fed bacon. That also was sent to the analyst, Mr. Harland.

5969. Is Davies's pea-fed bacon a foreign bacon?—Davies's pea-fed bacon is a Canadian bacon, and one of the best known brands; in fact, the best known brand possibly now of Canadian bacon. I had an interview with Mr. Harland a few days ago, and he described me the process of how he got the analyses. He cut out a piece of bacon from the flesh side of the gammon and also from the skin side, about an inch and a half square, right down to the bone; that he analysed and took especial

Mr. J. M. Harris.

22 Jan. 1900.

pains to arrive at very accurate results. The results were as follows, if I may be permitted to read them: The gammon which was cured by ourselves—that is, Harris's gammon—showed boric acid present to the extent of 0·13 per cent., which, I believe, is equivalent to 14·1 grains of borax to the pound of meat; Messrs. Oake Woods and Company's gammon showed boric acid present to the extent of 0·10 per cent., equivalent to 10·5 grains of borax to the pound of meat; and Davies's pea-fed gammon showed 0·12 per cent. of boric acid present, equivalent to 12·6 grains of borax to the pound of meat. These were all three treated in exactly the same way. (*See App. No.* 33.)

5970. These had been cured with borax?—No, certainly not.

5971. They had been mild cured?—Yes.

5972. And then packed in borax?—Yes.

5973. In your opinion the borax had penetrated the meat?—Undoubtedly. This, I think, is confirmed by the evidence which you have had given you here before by Dr. Hill, of Birmingham, who stated that he had found varying quantities of from 10 to 45 grains to the pound in meat.

5974. Did Mr. Harland make any further experiments?—Yes. For his own information he sprinkled some borax upon a fresh piece of pork in his laboratory, and after a week he found that the interior of the flesh showed boric acid present to the extent of 0·10 per cent., equal to 10·5 grains of borax to the pound. This, I think, goes against the contention that borax does not penetrate meat when sprinkled on the surface. It was suggested to me that I should have the number of grains weighed out. I had this done, and I was so struck with the three different amounts, not knowing much about decimals and that sort of thing, that I have brought them here (*handing in three packets containing the amounts of boric acid found in the three specimens submitted to analysis*). I may say, perhaps, that in speaking to different men whom I know in the trade, hardly one credited the statements that the process of washing American bacon did away with the borax. Practically, the men in the trade know that it does not, although they like to think so.

5975. You regard these tests as conclusive that it does not?—Undoubtedly. Mr. Harland has had a good deal of experience in analysing meat and bacon, and I think this is very conclusive.

5976. Was Harris's gammon dried before it was treated?—Yes, they were all three dried.

5977. Thoroughly dried?—Yes.

5978. I suppose that was fresh pork that Mr. Harland experimented with?—Yes, it was fresh pork. I may say that this was not meat taken from just the surface. Mr. Harland was very careful not to take the surface of the meat where the borax was touching—where it was put on; but he took it right out of the centre of the meat right down to the bone, which is, I think, a very important point.

5979. It has been represented to us that any interference with the use of preservatives would cause a very serious disturbance to the import trade; would it interfere with the home-curing trade at all?—I think there are no English or Irish curers (with very few exceptions) who use borax in curing.

5980. Why do you object to the use of borax?—Personally I do not; I have no reason to object to it; I do not know sufficiently about it to object.

5981. You would like, I suppose, to know when you are eating it?—I very seldom eat any foreign bacon that I know of. I think one point is that the witnesses you have had here before make statements to the effect that owing to the use of borax they can produce a mild-cured bacon.

5982. Yes, that has been said by several people?—I think Mr. Wheeler Bennett stated in his evidence that English bacon is not popular, owing to its being cured harsher and much salter, and that he can sell 3,000 to 4,000 sides of Canadian bacon to 100 sides of English bacon. In the first place, Mr. Wheeler Bennett never sold any English bacon; he is not an English bacon commission agent. So I think it is hardly fair to say that. In our own case we kill now three times as many pigs as we did in 1866. Beyond that, within the last three years there have been from a dozen to 20 new curing companies started in England, and there are more pigs now fed and bred in the West of England for bacon purposes than there ever were. I think instead of Mr. Wheeler Bennett stating as he did it would have been fairer if he had said that the cheapness of the American and Canadian bacon is the great inducement.

5983. They undersell you, I suppose?—At the present time there is a difference of at least 1½d. a pound, wholesale, between our price and the price of Canadian bacon.

5984. There is a great deal more shown in that list (*handing a list to witness*)?—This is a retail list, I take it.

5985. (*Dr. Bulstrode.*) It is the Army and Navy Stores list?—Of course, they sell it for as much as they can, but just at the present time our price is about 62s. a hundredweight and Davies's pea-fed bacon, which is the largest advertised bacon on the market is 48s., showing a difference of 14s. a hundredweight, or 1½d. a pound.

5986. (*Chairman.*) In short, you find it quite possible to meet the increased demand for mild-cured goods without the use of modern preservatives?—Emphatically, yes. Mr. Bennett says there is nothing better known than a slight sprinkling of borax to produce a mild-cured article; if he had stated there is nothing better known to enable a mild-cured bacon to stand the voyage from America, lying about on the wharves, etc., than borax, I think he would have been fairer to the English and Irish curers. May I say that a great many people think that borax forms a part of the cure; it does nothing of the sort; bacon by all the leading houses is cured entirely without the help of borax, and those who use borax make a very inferior article.

5987. We have been informed that it is possible for borax to get mixed with the brine, and afterwards to be pumped into the sides?—I believe a very few houses do that. It is absolutely unnecessary, and as I say we have cured bacon for 80 to 100 years without it. May I say that lately, I think possibly since this Committee has been sitting, we have had applications from some of our customers for guarantees—that is, that every invoice should guarantee that the bacon is unadulterated or pure, as they put it. They have asked for it in several different ways. To get over that difficulty we have had this footnote printed at the bottom of our invoices: "The goods mentioned on this invoice are warranted by us to be of the nature and substance they are described or purport to be, and to be pure." I believe some ladies have asked if this bacon is cured with borax.

5988. (*Professor Thorpe.*) You are exporters of bacon, I understand?—We are curers entirely, and we supply the trade; that is, the wholesale houses in London or elsewhere, will order us to pack so many cases of bacon for them to ship abroad.

5989. Does a considerable proportion of your bacon go abroad?—By far the larger proportion is consumed in England and Scotland.

5990. Is that which goes abroad differently treated from that which remains at home?—Only to the extent of a little more salt and a little more drying; it is dried at a little higher temperature.

5991. Do you know where the bacon that is sent abroad goes to?—Yes.

5992. Where?—Bombay, Calcutta (I think every fortnight's steamer takes out a quantity of bacon to Calcutta), Madras, Kurrachee, Cape Town, Johannesburg, China——

5993. In other words, it goes to all the hot places, or passes through, at all events, a part, which is very hot?—Yes. Some of the large steamship companies take a supply of our bacon to last them the outward journey and back again.

5994. Would they keep it refrigerated?—I should think they would keep it in a cool chamber, not in a frozen chamber.

5995. Is that bacon which is exported as you say in the ordinary way of trade to these hot climates kept under any special conditions?—Do you mean on arrival?

5996. No, as you send it?—No, it is packed in the hold.

5997. Then it may be subject to a very high temperature?—It is. We put on the cases, "Stow in a cool place" or "Stow away from the boilers." A good many private yachts take the bacon out to the Mediterranean for their supplies—that is, to last some months.

5998. You have had no complaints of the keeping character of that bacon under those circumstances?—No.

5999. We were informed that the French have recently relaxed their conditions with respect to the presence of borax in imported bacon; is that a fact?—I think not; I think that must be a misunderstanding in some way.

6000. What is your reason for saying that?—They are very particular. We send a lot of bacon to France, and

Mr. J. M Harris.

22 Jan. 1900.

do a big trade with Paris. Our customers there are always very particular in ordering bacon free from borax; it is almost a printed form with them—free from borax. Not only that, but I was in Paris a little time ago, and I heard from a very good authority there, and I also heard from a very good authority in London, that if bacon had been passed with borax in it, it was owing to the laxness of the officials at the Custom House. A little time ago, within the last ten days, I believe, at any rate a very short time ago, there were from 2,000 to 3,000 boraxed hams—that is, hams that were packed in borax originally—sent back to England, either London or Liverpool, wherever the owner happened to live.

6001. You know of no general order relaxing the condition as to the presence of borax in imported food?—On the other hand, I believe they are getting more strict from the information I have had given to me.

6002. The demand for mild-cured bacon or pork products, generally, is not contemporaneous with the rise of these boric preservatives, is it?—By no means. It is at least 20 years ago—longer than that—since mild-cured bacon first came to be made, owing to the introduction of improved methods. The old-fashioned plan used to be to kill pigs and cure the bacon in the winter for consumption through the summer, and then, of course, it was hard-salted. Now, owing to the improvements in the ice-house cellars, and then again since that the refrigerating machinery whereby the cellars are kept at one equal temperature winter and summer, curing is carried on as easily in the summer as in the winter, and bacon is made mild-cured. The Americans perhaps claim that it was their idea to make mild-cured bacon, but that is altogether a wrong idea.

6003. Then if it were represented to this Committee that the introduction of boraxed bacon has caused, by virtue of its mildness, a demand for that article, that would not be a correct representation of the fact?—Certainly not.

6004. It has been alleged that borax in bacon, and also in dairy products can be detected by its aroma; is there any truth in that statement?—It must be very strong indeed; it must be very much impregnated with borax.

6005. Has borax any aroma of itself?—No.

6006. Is it capable of giving any aroma to anything with which it is mixed?—I do not think you would smell it if you put your head into a cask of it.

6007. I think the chief object of your evidence is to show that mild-cured bacon can be produced and exported without the aid of borax or boric acid?—Yes.

6008. Are you able to export large quantities to greater distances than from here to America without the use of borax?—Yes. The difference is that the American bacon comes over in a green state to England, but ours goes abroad dried, fit for the shopkeeper to sell. When the American bacon comes here it has to be washed by the wholesale house and dried by him before the shopkeeper can buy it.

6009. Which is the milder bacon of the two in the end?—I think ours is quite as mild as the Canadian; it is certainly as mild as the Canadian.

6010. (*Dr. Bulstrode.*) I suppose you export most of yours to the Cape and to India?—Yes.

6011. At both of which places, I take it, people have had opportunity for many years of eating boracised bacon, or bacon packed in borax?—Yes, I should suppose so, but I do not know from my own knowledge.

6012. Do you think it is at all likely that the want of demand, we will say, in those places, or the contentment with your bacon is due to the fact that they have not tasted the borax packed bacon?—No, I do not.

6013. You do not think it is?—No; there is a very large quantity shipped of American and Canadian bacon by wholesale houses from London, and different parts, Liverpool for instance—American bacon that is washed and dried by them and packed up in the way we pack it.

6014. With regard to the withdrawal of the order prohibiting boric acid in France, you know, I suppose, that when that order was first enacted its operation was suspended for some time?—I do not know it.

6015. That is a fact, they suspended its operation for three months, if not for six months. Could you give the Committee any idea as to the proportion of home reared bacon in this country compared with the amount which is imported into this country from abroad?—The amount of bacon made in England and Ireland, do you mean, compared with the American?

6016. Yes, just roughly?—A very small proportion.

6017. Made in this country?—Made in this country.

6018. So that the vast majority which reaches this country is packed in borax?—The vast majority of the bacon that comes here is packed in borax certainly; the English and Irish bacon makes a much higher price. The American bacon mostly goes into the poorer districts and to the people who want a cheaper class of bacon.

6019. I did not quite understand, in regard to the experiments which you had made to ascertain the distribution of the boric acid in the hams, whether the surface of the hams was avoided?—A slice was taken off the flesh side before making a little square hole right down to the bone.

6020. It was not a piece cut out from above downwards—from the outside?—No. Supposing that was the top of the gammon, it was a piece taken out like you would scoop out a piece of Stilton, just right down to the bone. That was what the analyst took.

6021. Then he did take the outside as well?—He took a rasher off the top first, and then took a cube of meat out after the rasher was cut off.

6022. How thick was the rasher that was cut off?—The 1-16th of an inch, perhaps.

6023. So by these experiments one cannot definitely say that the borax had penetrated to the bone, could one?—It had penetrated to the bone undoubtedly, because the bottom of this cube of meat was cut clean away from the bone; it was down on to the bone.

6024. But the different parts of the cube were not examined separately, were they?—No.

6025. So that it might have been all in the first half of it, and none below for all that these experiments show?—But the analyst said that in the piece of meat that was touching the bone there was borax.

6026. Then he made more extended experiments than you have given us the details of, if that was so?—I take it he took a cube of meat, a piece of meat out, after cutting the rasher off; he took the square piece out right down to the bone, then turned the gammon over and cut a cube out from the other side, so that he would get a piece of meat from the top part of the gammon, and a piece of the meat from the under part of the gammon. He would not go through the bone. Here is the analyst's report.

6207. I see that he says, "In order to ascertain to what extent it had penetrated, a piece was in each case cut from about the middle near the bone." Possibly those words meet my criticism?—Yes.

6028. (*Dr. Tunnicliffe.*) What do you think would be the effect upon the price of bacon of prohibiting preservatives, that is to say, borax?—Do you mean the price of the American bacon?

6029. I want to know the probable effect upon the price of all kinds of bacon?—I could not say at all. Good American bacon would undoubtedly have to be made a trifle salter, but I do not see that that would add anything to the price. You are talking about putting borax on purpose to bring it over here to stand the voyage?

6030. That is what I am talking about?—If borax were prohibited, I see no reason at all why bacon should not be put into a refrigerating chamber the same as fresh meat is brought from New York in very large quantities. That does not add to the price of that fresh meat; American beef is cheap enough.

6031. Putting the question in another way; do you think that the addition of borax, as we know it is added—namely, in packing—is the cheapest way of getting green bacon over from America?—Undoubtedly.

6032. Therefore the presumption is that if borax were prohibited the bacon would be dearer?—Owing to the more costly system of carriage?

6033. Yes?—Very possibly.

6034. Do you think at the present time this American bacon brought over in this way competes with English bacon?—It does to a certain extent, because it is sold so very much cheaper. I think if a wholesale house asked the same price for American and Canadian bacon as he would for English there would be no American or Canadian bacon sold.

6035. Do you think any possible injustice which may be done to the trade in English bacon, at the present time, by the use of borax, would be met if the borax

Mr. J. M. Harris.

22 Jan. 1900.

were declared on the bacon?—I think if borax is used it should be declared.

6036. You think that would to some extent do away with any possible injustice which is being done to the trade in English bacon?—Yes.

6037. (*Professor Thorpe.*) Would there be any serious trade objection if the bacon, say, in Canada, or in the States, were smoked before it is brought over here, and not imported green? Would that make any difference to the trade?—It would not travel so well; it would not look so well on arrival here.

6038. As it would green and covered with borax?—As it would green and covered with borax, and smoked here.

6039. (*Dr. Tunnicliffe.*) Did you ever hear of a substance called "smokine"?—Yes; but we have never used it.

6040. It is commonly used, I understand?—I should say not by the principal curers, and not by the best curers. It is always the genuine smoke that is used by the best curers.

6041. Have you had it brought under your attention by agents?—Yes.

TWENTIETH DAY.

Monday, 5th February, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Dr. F. R. Blaxall.

DR. FRANK R. BLAXALL, called; and Examined.

5 Feb. 1900.

6042. (*Chairman.*) I understand you are a Doctor of Medicine and Lecturer in Bacteriology in the Westminster Hospital Medical School?—Yes.

6043. Also bacteriologist to the Vaccine Department of the Local Government Board?—Yes.

6044. I understand that you have undertaken experiments in dealing with the bacteriological action of the preservatives used in food?—Yes.

6045. What was the object of your experiments?—The first idea was to try whether it was possible with small quantities of formalin to sterilise milk, and then I had an idea that it might be possible to drive off that formalin and leave the milk sterile; however, that I found impracticable, and so I pursued it within the lines indicated in my *précis*.

6046. Did you ascertain the exact proportion of formalin necessary to sterilise milk?—Yes, I found it required 1 in 500 to effect sterilisation.

6047. In what respect can formalin be said to sterilise milk?—By killing out all germs in it.

6048. Does it actually kill them?—It actually kills them and leaves the milk perfectly sterile. It may be kept indefinitely with that quantity of formalin added. I have got milk now in which 1 in 500 of formalin has been added, which has kept seven months.

6049. Do you consider that the vitality of these bodies is absolutely destroyed?—Yes.

6050. Not merely suspended?—No, entirely destroyed.

6051. Would you tell us the proportion?—One in 500.

6052. Could you describe the method of procedure?—The method was this: I bought the milk from a local dealer, or several local dealers rather, in London, and the milk was received into domestically cleaned vessels, that is to say, not sterilised vessels, but vessels such as would be used in a house, and clean. Then from these vessels the milk was measured out in known quantities. In some experiments I used 500 cubic centimetres, in other experiments 100 cubic centimetres, and this quantity, either 500 or 100, was poured out into other domestically cleaned flasks.

6053. Did you ascertain whether the milk was free from preservatives?—I did that in the first instance. I tested them all for formalin, but I did not test them for boracic acid beyond the first two, nor for salicylic acid. The bacteriological test which I applied to the control milk practically settled that, or rather, it showed that the milk was in a normal condition. With regard to the formalin I never found any trace of formalin in the milk from the test applied.

6054. Then you added the formalin to each lot?—Yes. The preservative was then added in a certain quantity to each portion of milk in one of these flasks; and the flasks hermetically sealed and set aside in the conditions of the experiment. One such flask was used as a control, no preservative was added to it, and it was at once bacteriologically tested.

6055. How long will the milk keep hermetically sealed without the addition of formalin?—Without the addition of any preservative the controls all went bad within twenty-four hours, I think, with only one exception the whole time, and that happened to be a very cold night.

6056. Then you examined these flasks periodically?—Yes, they are always examined twenty-four hours after being preserved by first of all seeing if they curdle, or if they show any separation, and by smell, as to whether they smell sour or not, and then by bacteriological examination. It was always found in that connection that just at the point of sourness, if the milk had gone sour with the preservative added, the milk contained almost as many organisms as the control milk, which contained no preservative, whereas if the milk had not gone sour the number of organisms was very much less.

6057. Did the season and the general temperature of the air make any difference?—Yes, most decidedly. The lower the temperature the longer the souring of the milk was delayed.

6058. What I mean is, did you find the bacteriological fermentation more active at one season than another?—Hardly that, because my experiments only extend over about seven months and in the latter part I used a high temperature—that is, I incubated them, and so I eliminated the outside temperature. In the earlier part they were exposed to room temperature varying from about 55 degrees Fahrenheit to 70 degrees Fahrenheit.

6059. What number of experiments did you make with formalin?—Thirty-eight.

6060. Then you made others with boracic acid?—Yes.

6061. How did the results contrast?—Boracic acid proved itself a much less favourable germicide or even antiseptic than formalin.

6062. In what proportion was the boracic acid applied?—Boracic acid will not sterilise milk in any proportion that I used, and I used as much as 1 in 33.

6063. (*Professor Thorpe.*) That is almost as much as the milk will take up?—Yes, it will only take up 1 in 25 or thereabouts.

6064. That is what you may call a saturated solution?—One in 33 prevents any fermentation, but it allows organisms to grow most freely all over the milk, on the creams especially. The same with 1 in 50 and the same with 1 in 100; beyond that, with 1 in 200 the milk sours.

Dr. F. R. Blaxall.

5 Feb. 1900.

6065. Eventually?—Yes. It sours within three days frequently with boracic acid, but not always; it always does in twenty-four hours at 80 degrees Fahrenheit.

6066. (*Chairman.*) Did you ascertain how long in regard to your milk samples it was since the milking?—No, I did not. I bought them purposely from a London dealer. My experiments were all done with commercial milk, as it were, just as it went to the consumer. The milk, as I have shown from the control experiments and bacteriological examination, certainly except in two instances, must have been comparatively near milking time, as the number of colonies found in a certain proportion of the milk was very uniform all through the experiments, averaging about 200 colonies per platinum loopful.

6067. In what form did you use the boracic acid?—I had to use it solid for the higher percentages.

6068. In crystals?—Yes, in crystals, but in the small quantities I used it in solution and then it was quite inefficacious.

6069. Then your conclusion is that boracic acid is a much less effective preservative of milk than formalin?—Yes, much less.

6070. What results did you get from salicylic acid?—Salicylic acid I found as little efficacious as boracic acid—in fact, the milk saturated practically with salicylic acid, containing 1 in 400, is not sterilised, and eventually goes bad.

6071. (*Professor Thorpe.*) I understand that you made your experiments rather from the point of view of the scientific man?—Quite so.

6072. That is to say, you were actually studying the course of the action of preservatives upon the milk?—Yes.

6073. You were not actually imitating the conditions under which those preservatives would be used practically?—No, not that I know of.

6074. Have you any knowledge of how they are used commercially?—I have no expert knowledge at any rate—not more than a general outline.

6075. You cannot say, therefore, how far your experiments would throw light upon the course of the changes which would occur in actual practice?—No; not knowing the actual methods, I must decline to say.

6076. Such amounts, for example, as 1 in 500 of formalin are not those which obtain under actual conditions, are they?—I cannot say I am sure. These results of course apply simply to the experiments done under the conditions stated. I have no intention of applying them.

6077. You have no knowledge, have you, of the amounts which are recommended by the Formalin Company to be used antiseptically in milk?—No, I do not know that.

6078. From your experiments would you say that such an amount as 1 in 10,000 might be a suitable quantity to use?—I have shown that 1 in 10,000 will keep the milk sweet for a short time.

6079. What do you mean by a short time?—For possibly twenty-four hours at 60 degrees Fahrenheit.

6080. Would such an amount as 1 in 10,000 keep it sweet, say, at 80 degrees Fahrenheit?—No, I never found 1 in 10,000 keep it sweet.

6081. One in 10,000 in your experiments could not keep it sweet for so long a time?—No.

6082. And it never did?—It never did.

6083. (*Chairman.*) When you speak of keeping it sweet for twenty-four hours, you mean after you had purchased it from the vendor?—Yes.

6084. That would probably be from thirty-six to fifty hours after milking, would it not?—I should think very likely, but I do not know.

6085. (*Professor Thorpe.*) Of course, not knowing the age of the milk when you actually made experiments on it, there is a considerable amount of uncertainty as to the direct application of your results?—Yes.

6086. Would you say, from your experiments, that 1 in 50,000 of formalin would be of any use in keeping fresh milk sweet for twenty-four hours on a hot summer's day?—It entirely depends upon what comes in contact with the fresh milk. If fresh milk is practically sterile, and if it is received into sterile vessels, it does not matter whether you add the formalin or not.

6087. Assuming the milk is received under ordinary practical commercial conditions, do you think an amount so little as 1 in 50,000 would be of any practical use in keeping milk sweet for twenty-four hours on a hot summer day?—No; I do not think it would be of any use.

6088. You think it would be of no use?—That is so.

6089. In order that we might quite understand your experiment, what is formalin?—Formalin is a 40 per cent. solution of formaldehyde.

6090. Your experiments have had reference to what?—To the actual amount of formalin as formalin, not as formaldehyde.

6091. Again I will put it: When you stated that you thought 1 in 50,000 of formalin was of no practical use in keeping milk sweet for twenty-four hours at a summer temperature, you meant formalin?—I meant formalin.

6092. Have you any knowledge of the specific action of formaldehyde on the constituents of milk?—Only generally speaking.

6093. Can you tell the Committee what you believe that action to be?—No, I do not think I would care to go into that. I am not sufficiently *au fait* with the subject.

6094. Now, as regards boracic acid, that, you tell the Committee, was a much less powerful germicide and antiseptic than formaldehyde?—Yes, much less powerful.

6095. Have you any means of comparing commercially the relative antiseptic effect of boracic acid and formaldehyde? You say that 1 in 50,000 of formalin will have no inhibitive effect on the milk?—Yes.

6096. Would 1 in 2,000 of boracic acid have any more powerful effect in preventing the change?—At that temperature you have mentioned—a hot temperature?

6097. At that temperature?—In my experiments it had no effect whatever.

6098. Then we may gather from you that such quantities as 1 in 2,000 of boracic acid and 1 in 50,000 of formalin would have no material effect in keeping milk sweet?—That is the evidence I have obtained in my experiments.

6099. Therefore, there would be no use whatever in adding those preservatives in such amounts to milk?—It is rather strong to say "no use whatever." Of course, probably every little preservative you add must have a certain inhibitive effect, but according to my experiments it will not keep the milk sweet. I will not say it will have no effect whatever.

6100. Would it allow the formation of such an amount of lactic acid, or would it prevent the formation of such an amount of lactic acid as to make the milk unsaleable?—In my experiments it did; it rendered it quite sour.

6101. Then it would not have the effect of preventing the formation of lactic acid?—No.

6102. (*Dr. Tunnicliffe.*) Could you tell the Committee about the quantity of bacilli that can be contained in milk for the milk to be still drinkable—that is to say, what milk from a bacteriological standpoint would you regard as normal?—I think, for commercial milk, 200 organisms per loopful, mounting even up to 500 organisms per loopful, is a very fair milk. It is rather impossible to give in definite quantities the number of organisms which would render the milk undrinkable, because it all depends upon what the organisms are, you see—the kind, I mean.

6103. Can you say what quantity of organisms, of course, roughly, would render milk undrinkable or unsaleable?—In the summer I bought two samples of milk, one containing 20,000 organisms per loopful and the other 40,000 per loopful roughly. That was milk which was for sale, and there was no evidence, as far as smell went, that it was sour at all.

6104. Have you any facts that you can tell the Committee concerning the relation between the amount of injuriousness and the number of organisms in milk?—The probabilities are that the greater the number of organisms the nearer the milk is to sourness, if not already sour, and, therefore, the nearer to decomposition, of course, generally. As a general fact there is no question about that. In some of these milks to which preservatives have been added, say, boracic acid in the proportion of 1 in 100, I have found that the number of organisms is practically innumerable and yet the milk has not gone bad; fermentative action has been stopped, but the other organisms are allowed to go on.

6105. Therefore, I take it, that, in spite of your bac-

Dr. F. R. Blaxall.

5 Feb. 1900.

teriological experiments, you would still regard the question of sourness in milk as the essential test?—Yes, certainly.

6106. That is from the point of view of injuriousness?—Certainly.

6107. What quantity of formalin would you recommend to be added to milk to keep it for twenty-four hours drinkable at a constant temperature of 60 or 70 degrees Fahrenheit?—I should say not less than 1 in 5,000.

6108. Would you also tell us how much boracic acid under similar conditions you would recommend?—One in 200 is what I found in boracic acid; I should not recommend that to be added though.

6109. Have you thought about the preservative action, or rather, I should say, the antiseptic action, of these preservatives from the point of view of their toxic equivalents?—I am not prepared to give an opinion about that; of course, one has thought about it.

6110. You are not prepared to give an opinion of the relation of their antiseptic power to their toxic equivalents?—No.

6111. Of course, that, you would agree, is essentially the important point?—Quite so.

6112. (*Dr. Bulstrode.*) With regard to the formalin which you used, did you test it to ascertain whether it was a 40 per cent. solution of formaldehyde, or did you take that upon the guarantee of the firm?—No, I specially got the formalin guaranteed, and for these experiments I used formalin from three bottles, which were all kept hermetically sealed, and I found no differences between any of the three.

6113. You mean as regards their reaction—their inhibitive effect?—Yes, I took it that that was sufficient.

6114. You did not test it yourself?—No, I did not test it; there was no chemical analysis of it at all.

6115. During what periods of the year did you collect these samples of the milk which you tested?—I commenced the milk in May and I went on through May and June, then, I think, in rather a desultory fashion up to August, and I commenced again in September, and all through this autumn and winter I have been working at it systematically.

6116. You did not test these samples of milk except, in the first instance, for the presence or absence of preservatives?—I did test them all for formalin.

6117. But not for other preservatives?—I tested the first two or three for boracic acid and salicylic acid, but I found the process rather lengthy, and, as it required a considerable quantity of milk, I did not carry it on.

6118. Would you think that the relatively small number of bacteria present would rather point to the fact that some preservative had been added?—That occurred to my mind at first, and I did have the first two or three tested; and, as the control always went bad within a very speedy time,—as I say, within twenty-four hours—I did not consider that, at any rate, the preservative was there in sufficient quantity to do much harm or much good either.

6119. As regards the multiplication of micro-organisms in milk, I rather gathered from your experiments that you would not quite endorse this statement. I will read you the passage: "As further illustrating the influence of temperature, it may be mentioned that a difference of 10 degrees centigrade made a difference in milk kept for fifteen hours of 71,900,000 bacteria per cubic centimetre; in milk kept for twenty-four hours at 25 degrees centigrade no less than the gigantic number of 577,500,000 bacteria per cubic centimetre had been found." If that is true, does not that rather tend to point in the direction that there may have been some boracic acid in your original milk which was inhibiting the growth of the organisms?—I cannot say it was not. It was not the case in the first, as I did have the first two or three samples examined, as I say, and I never found any then. But I do not think that proves that point at all.

6120. It does not prove it, but do you not think it points in that direction?—No, because, you see, they always went bad; if there had been sufficient there to inhibit to that extent the milk would have kept at about that number of organisms.

6121. As regards the control experiments you say that after twenty-four hours the controlled milk with only one exception was sour, and showed on plate culture a great increase in the number of organisms present, varying from 40,000 to 200,000 per loopful?—Yes.

6122. Would you explain to the Committee the exact relation of a loopful to a cubic centimetre?—I am not prepared to do that.

6123. That is rather an important point, is it not?—I should have to measure that particular loopful, and I have not done so.

6124. You have been speaking in terms of loopfuls, and I have been reading in terms of cubic centimetres?—I should say more than 100 loopfuls would go to a cubic centimetre.

6125. Of course that makes a lot of difference to the argument?—Quite so.

6126. Did you go into the differentiation of the organisms which you have found in the milk?—No, practically there was no qualitative work done.

6127. With regard to the boracic acid expressed in grains per pint or grains per gallon, how much did you find necessary to keep milk sweet for twenty-four hours?—I make it that about five grammes to the pint is enough to prevent any fermentative action. The 15 grammes to the pint mentioned in my *précis* represented the 1 in 33, but it only requires 1 in 100 to stop fermentative actions, therefore it will come to about 5 grammes to the pint.

6128. In order to produce inhibition?—Yes.

6129. And sterilisation?—No; boracic acid will not sterilise according to my experience at all. It will stop fermentative action, but it will not sterilise.

6130. What it would really come to is that a proportion altogether in excess of anything like the pharmacopœial dose of boracic acid is necessary to keep the milk sweet?—Yes.

6131. Have you made any culture experiments with regard to the inhibition of the growth of organisms by the addition of boracic acid?—Apart from milk, do you mean?

6132. Yes?—No, I have done nothing bearing upon that.

6133. Your experiments seem to show that the several preservatives which you use have a distinctly selective action upon the several organisms which set up fermentation and produce changes in the milk?—When used in certain proportions.

6134. And that in the first instance the several bacteria which are thought of as being an influence in bringing about lactic changes are inhibited or killed?—Yes.

6135. And that secondly those which bring about butyric changes are also inhibited or killed?—Yes.

6136. And that finally you found certain vegetable moulds to be most insistent?—Yes, finally; proteid decompositions are inhibited before moulds.

6137. Really what your experiments point to, do they not, is that the sourness in milk is really only a very poor indication of what other changes may be going on in the milk?—Quite so.

6138. So that there may be harmful changes going on quite apart from lactic acid changes?—Yes, but they are nearly all distinguishable by smell. The milk is not sweet, and I do not think the milk would be sweet which had processes going on which would be deleterious—other than the presence of pathogenic organisms.

6139. That is to say, for all you know?—Yes, quite so.

6140. With regard to the pathogenic organisms, could you tell the Committee—it is an interesting point—how far these several preservatives in the strength you use might be regarded as having an inhibitive or destructive effect upon pathogenic bacilli?—I think the non-sporing ones, for instance, such as typhoid and so on, may be expected to be inhibited with less quantities of preservatives than it would require of course for the complete sterilisation of milk, and probably even for the inhibition of ordinary saprophytes such as the lactic acid bacillus.

6141. Do you regard the lactic acid bacillus as less resistant than the typhoid bacillus?—No, it is more resistant.

6142. So that you think the pathogenic organisms such as those of cholera, typhoid fever, and tubercle, are less resistant than it?—Yes; I am not quite sure, but I think 1 in 7,000 of formalin is sufficient to kill the typhoid bacilli. I am speaking rather from memory, but I believe that is the amount.

6143. Have you had any experience as regards the hardening effect of formalin on sections?—Yes.

Dr. F. R. Blaxall.

5 Feb. 1900.

6144. Would you tell the Committee about that—as to the strength you used and what you found?—I cannot go into that. One knows that formalin does harden sections and so on, but I am not prepared to give the strengths.

6145. (*Chairman.*) You were speaking just now of the relative vitality of different micro-organisms; have you any experience as to the resistance of the bacillus of anthrax to formalin?—I have no personal experience, but anthrax spores are extremely resistant I know. I could not give the figure just at this moment, but it has been worked, of course.

6146. Would you consider that 1 in 500 of formalin would destroy the spores?—Of anthrax, yes; I believe 1 in 500 would destroy any bacteriological organisms, because milk generally contains spores as resistant as anything that is known.

6147. Have you ever made an experiment by testing the milk some hours after the formalin has been added?—Yes, and the diminution is very rapid indeed.

6148. The diminution in formalin?—I beg your pardon—I thought you meant with regard to the organisms.

6149. I meant as to the amount of formalin at the end of a given time compared with what was added?—That I have never done chemically. I took the precaution in my experiments that all those vessels should be hermetically sealed, so that at any rate there should be no escape of formalin as a vapour.

6150. It has been given in evidence that there is a tendency or property of formalin to conceal itself, that is, to unite itself with certain parts of the milk so as to escape detection, but you have no light to throw upon that?—No, I have not.

6151. (*Professor Thorpe.*) I presume the amount of formalin which is necessary actually to kill pathogenic organisms—absolutely to kill them if they are there, not merely to inhibit their formation—would render the milk in all probability unsaleable?—I should think so certainly.

Mr. Henry Charles Cameron, called; and Examined.

Mr. H. C. Cameron.

6152. (*Chairman.*) You are the produce commissioner to the New Zealand Government?—Yes, I am.

6153. You have some information to give us relating to the dairy industry in New Zealand and its connection with this country?—Yes. It is connected with this Inquiry principally in relation to butter.

6154. Yes, for I suppose you do not intend to send fresh new milk to this country yet?—No.

6155. The output of butter is increasing in New Zealand, is it not?—Yes, it has been steadily increasing for a number of years.

6156. We may assume that the quality is good?—It is steadily improving.

6157. Steps have been taken by the Government in New Zealand to organise the trade and encourage it, I believe?—Yes, to improve the making of the butter in the colony both by instruction and by inspection.

6158. The points on which the Committee desire information are first, the extent to which the preservatives are used in the transport of butter to this country, and secondly, how far they seem to you necessary to it, or how far they could be dispensed with?—Have you any particular questions on that to lead up to it, or do you merely wish me to give you evidence as to how butter is made in the colony and the extent to which preservatives are used.

6159. I suppose to carry fresh butter from New Zealand to this country implies certain precautions or special needs?—Yes. The butter in New Zealand is generally made at the dairy factories. Those are central factories established throughout the country to which the producers bring their milk, and butter is made there by the best means known and is then, after making, inspected and graded by Government inspectors.

6160. That is not exactly what we understand by a butter factory in this country; we should call that a creamery?—I think they use either word in the New Zealand Act if I am not mistaken, but we generally think of them as dairy factories.

6161. You do not recognise the difference of the producer sending in the butter to be made up in the factory?—That is what we call milling it in New Zealand, and that butter is placed under a different heading from the factory butter, which is considered the choicest butter. What is made in the factory or creamery is butter made from milk that is obtained from the producers and brought direct into the factory. What is termed, as you term it in this country, "factory" butter, or what we term "milled" butter, is butter that is made by the numerous farmers in little lots throughout the colony. We will say storekeepers, as we call them—you call them grocers, I suppose—go round weekly and give their stores—you call them groceries—to the farmers and take in exchange butter; then, when they get that butter home, it is placed in their store warehouse and is milled—that is to say, it is all mixed up. I understand you call that system in this country the factory system.

6162. Yes, that is what we understand by a factory?—We call that milling it, and that butter is not considered to be first-class butter. The butter that is, you may say, taken in hand, or that the Government interests itself mostly in, is what is called factory or creamery butter; and it is quite a high-class butter compared with the other.

6163. That is, it is exported in large quantities, fresh?—No, it is not exported fresh to any extent. It is treated with salt, and in many cases—I will not say in every case, but in many cases—with Preservitas, as we call it.

6164. (*Professor Thorpe.*) Preservitas?—Or a preservative.

6165. (*Chairman.*) What is the basis of that?—Boracic acid, I understand, principally.

6166. Is there no butter that comes absolutely fresh to this country?—I am told (and from my own experience I have found) that this last year or for a couple of years there has been a little sent—in fact, last year I believe it was increasing. They find there has been rather more sent than the demand here for fresh butter of that description warrants. The bulk of the New Zealand butter is sent over here treated with salt.

6167. As the Danish butter is?—Yes; but a good deal of it, of course, with preservative.

6168. How does it compare in price with Danish butter?—It is cheaper than the Danish butter. Danish butter is made in Denmark, and is on the market here, you may say, in a few days. New Zealand butter, of course, requires to be placed in cold stores and frozen during transit, and it is, possibly, a couple of months before it is put on the market here. The action of freezing also affects the butter.

6169. Is it all frozen that comes to this country?—It is all frozen that comes over here; it is carried in refrigerating chambers generally at a temperature—it is my duty to see that the temperatures have been kept correctly—of, I should say, about 15 degrees Fahrenheit on an average—the same temperature as they bring frozen meat over in.

6170. The salt that is used comes into play when the butter is taken out of the refrigerator, does it not?—The salt is put into the butter, of course, to act as a preservative, but the demand in this country is for a butter with a slight flavouring of salt, and, naturally, you try to hit the taste of the majority of purchasers.

6171. What is the object of adding other preservatives—boracic acid, for instance?—The object of adding other preservatives is this: when New Zealand butter is frozen and is taken from the chamber here, and put, as we call it, on the floor of the merchant's warehouse, and from there on to the counter in the shop, the action of freezing causes it to depreciate more rapidly than if it were not frozen. The action of frost causes it to go off, as they say, more rapidly, and the preservative has been found by tests made in New Zealand, by the Agricultural Department of the Government, to aid the keeping quality of the butter when thawed.

6172. But you say the use of boracic acid is not universal?—It is not universal, I understand.

6173. Is it increasing?—There has been a complaint about preservatives in this country, and objection has been taken to using them, as you know. Naturally, butter makers do not know what the result may be, and some of those in the colony have been rather nervous about using

Mr. H. C. Cameron.

5 Feb. 1900.

preservatives in the face of that. But, while the New Zealand Government is most anxious, by the stringent measures they take and by their Act, which I can show you, to have the butter exported only in a pure condition, it is found that the finest butters made in the colony, and the butters that command the best price on this market and obtain the highest reputation, are those treated with a slight application of preservative.

6174. Your Government have undertaken some experiments, have they not?—Yes, some very interesting experiments, of which I have got some particulars here (*handing in "Reports on the Dairying Service,* 1897-98, *to the New Zealand Department of Agriculture"*). The experiments were made by the Agricultural Department of the New Zealand Government with the object of ascertaining whether the use of preservatives was beneficial or not.

6175. You mean effective or not?—Yes, effective in preserving the quality of the butter. They recognised, of course, that if the preservative is of no benefit it should not be used. The experiment was this: "Six boxes of butter, all from the same churning, were treated with different percentages of salt and preservative. The latter was of a well-known brand, consisting mainly of boracic acid. The butter was treated and packed by the manager, and each box was marked with a distinguishing letter, only the manager knowing the treatment of each particular box. The butter was packed on the 9th January, 1898, and was forwarded to the grading room"—that is where the Government inspectors see that the butter is in perfect order, and grade it according to quality—"at Moturoa Freezing Works, where it was carefully examined and pointed on the 12th January. As might be expected, we could not detect any appreciable difference in flavour between any of the boxes, and awarded 41 out of a possible 45 points for this item. The loss of the four points was accounted for by the presence of a slight 'feed' taint"—that is, a taint that has been derived from the feed—the grass. "The butter was then placed in the freezing chamber and kept at a temperature of 29 degrees Fahrenheit for eleven weeks"—that is about the length of time. of course, that there would be between the time it was made and the time it was put on the market in this country—

6176. Yes, but at a much higher temperature?—It is a temperature below freezing-point, you see.

6177. You mentioned 15 degrees?—Yes, that is the average temperature at which it is carried across in the boats; but it does not matter as long as it is below freezing—below 32 degrees.

6178. It matters in this respect, does it not—that the lower temperature would have a much more disintegrating effect?—The more reason, of course, for a preservative—that, perhaps, would be even a stronger proof for the use of it. "The butter was then placed in the freezing-chamber and kept at a temperature of 29 degrees Fahrenheit for eleven weeks, when it was defrosted and held for ten days in a temperature ranging from 45 to 60 degrees"—as it would be in the stores and shops here. "It will thus be seen that the butter was subjected to conditions very similar to those it would have to undergo if exported to England, and that we saw it as it would probably appear to the English consumer"—that was the object of the test. "It was now re-examined by Mr. Robertson and myself, as well as by several others interested." The boxes were marked A, B, C, D, E, F, and when examined for pointing—that is, to give the number of points—it was found that box E, which had been treated with 3 per cent. of salt and a half per cent. of preservative was superior to the second sample (D), which was treated with 2 per cent. of salt and 1 per cent. of preservative, the third quality box (F) having 3 per cent. of salt and 1 per cent. of preservative.

6179. The third box was nearly the same as the second?—Yes, but it was placed after the other because, although there was very little difference in pointing, the other was reckoned, if anything, the better. You see they were both preserved with 1 per cent. The other three boxes had no preservative, and they were inferior to those three with preservative. So that the experiment has proved this—that the use of preservative to a small extent—that is, to the extent of a half per cent.—is beneficial; that it is quite unnecessary to use more than that; that 1 per cent. does not give as fine a keeping quality of butter as a half per cent.; and, of course, it is not the object of anyone to put more in than is absolutely necessary.

6180. Would you give the percentage of salt in the samples without the preservative?—Box A had 2 per cent. of salt, similar to D. Box D had 2 per cent. of salt and 1 of preservative. Box B had 3 per cent. of salt and no preservative. Box E had 3 per cent. of salt and half per cent. of preservative. Box F had 3 per cent. of salt and 1 of preservative. They tried to have them as equal as possible without and with preservative. The proof of this, I think, is that the difference alone in preservative makes the difference in quality.

6181. Then a half per cent. of preservative is as effective as any larger quantity?—They considered more so. This experiment I may say, as you will see if you look a little further down, was made by those who really held the opinion that a preservative was perhaps not necessary, and who would have liked, if possible, to have proved that by doing without preservatives they would be complying with the requirements of this country and could make as good a butter. But as the Commissioner says: "We admit, however, that this experiment, subject to confirmation, indicates that boracic acid has a certain value as a preservative for butter; that 8 ounces"—that is a half per cent.—"per 100lbs. of butter is as efficacious as any larger proportion; and that the addition of as much as 1lb. per 100lbs. of butter imparts a noticeable and unpleasant taste"—which, of course, you do not wish to have. "Why D should have kept as well as F, or B better than C in spite of being more mildly salted, is a question hard to answer."

6182. You said the preservative used consisted mainly of boracic acid—what other ingredients?—Boracic acid and borax generally; but, of course, I am not a chemist and I am not an analyst.

6183. What is the object of using a patent mixture when boracic acid could be used apparently with the same effect?—Because it is made specially for application easily.

6184. In solution?—No, it is like a very fine salt. Of course you have had a great deal of evidence given as to the manner in which a preservative is applied to milk; its application to butter or to prepared foods is quite different. The makers weigh the quantity of butter, the quantity of salt, and the quantity of preservative; they mix the preservative and the salt together, or they may apply them separately in the same manner, and they are mixed with the butter at a time before the butter is put into the boxes. The butter makers know exactly the quantity that they are mixing or blending with the butter.

6185. From what distance do the farmers send their milk to these factories?—Not very far. New Zealand is not a large country; it is a country about the same size as this, and something of the same shape—long and narrow. These factories are established all over the colony. There are 400 or more factories and skimming stations throughout the country, and they are placed in the centre of farming communities; the farmers within say three or four miles round sending their milk in night and morning to them. That is the general system.

6186. Is the use of preservatives unknown among the farmers themselves, or do they ever treat their milk before consigning it?—I understand not in New Zealand; it is not necessary.

6187. But there is nothing to prohibit them?—There is nothing to prohibit them further than the Dairy Act, and the New Zealand Act is very stringent; in fact, I do not think the English Government would agree to introduce such an Act into this country for the farmers. The powers of the inspectors there are very great. There are many things which an inspector can do in connection with the dairy industry. A dairy means a milk house, a milk shop, a dairy factory, or any other place where dairy produce is collected; it also means a farm, a stockyard, a milking yard, a paddock, a shed, a stall, or any place from which the milk supply of a dairy is obtained. The inspector can go in and inspect all those places and if in any case where the inspector is satisfied—and he has only got to be satisfied—he can prohibit and stop the distribution of produce from that dairy.

6188. If he is satisfied of what?—If he is satisfied that things are not as they should be. Suppose they are dirty, suppose there is carelessness displayed; suppose that he thinks the produce is injurious to health; suppose he sees any fault, then he can stop the making of dairy produce at that dairy.

6189. Would the use of a preservative by a farmer in consigning his milk to the factory justify the inspector in prohibiting that supply?—No, not at present. I do not think it would.

Mr. H. C. Cameron.

5 Feb. 1900

6190. What I mean is this: is there any safeguard against this New Zealand butter containing no more preservative than is added in the factory?—No, if the farmer added it to his milk before going to the factory there is nothing to prevent it, but in New Zealand the farms are situated so close to the factory that it is almost unnecessary. I do not know, and I could not say of my own knowledge that it is not done; at the same time I could not say that it is done. I cannot give you that evidence, but it is unlikely, unnecessary, I consider, that it should be done. Of course, it could be done.

6191. You have already said that New Zealand is a country about the size of Great Britain; you are possibly aware that some farmers in this country do use preservatives in sending their milk?—Yes, they do.

6192. Why should the New Zealand farmer not do the same?—They use it, I understand, principally here when they are sending milk some distance for consumption as milk. I am not aware that they do it when sending it merely into the factory a mile or two away for immediate use.

6193. No, but when a perishable commodity has to pass through several hands there is no warrant that some of these parties may not use preservatives?—No, there is no warrant.

6194. (*Professor Thorpe.*) Perhaps you will allow me to clear that up; boracic acid or borax is soluble in the fluid of the milk?—Yes.

6195. If the farmer did add it, it would be dissolved?—I see; there is nothing to prevent him.

6196. It would be dissolved in the milk as such, but it would not be dissolved in the fat, which is, of course, obtained from the milk and made eventually into butter?—I am not chemist enough to say that; that is expert evidence.

6197. (*Chairman.*) Has there been any system of pasteurisation or sterilisation adopted by dairies in New Zealand?—Yes, to a slight extent.

6198. With what result?—Rather unfavourable.

6199. As regards the quality or flavour of the butter?—As regards the condition in which butter from the colonies is when brought home and handled. Pasteurisation, as I suppose you know, is intended to remove taint in milk. Taints are caused by bacteria which are developed, we will say, by uncleanliness. Pasteurisation levels the quality of the milk. It removes the taints, and while removing the bad taints, of course, it removes also the fine taints—it removes all taints. Butter makers then make their butter with what they call a starter, that is, they apply a starter to give the butter the flavour which is desired.

6200. A ferment you mean?—Yes, a ferment. Then when the butter is made you can understand it is uniform. The effect of pasteurisation is also such as to keep it for a longer time than if it were made from milk in its natural condition. But while making this average quality of butter the pasteurisation has destroyed the fine qualities, the fine flavours, of the milk, and you cannot make as high a quality of butter, as fine a quality of butter, as you can by the natural process of ripening. The idea in New Zealand is not so much to make an average uniform butter as to educate the farmers to make the finest quality of butter. Pasteurisation levels. It has been found in London by tests—they have been watching it very closely—that the pasteurised butter sent from the colony after being frozen is not quite so good as the non-pasteurised butter. The feeling is not quite so strong now in favour of pasteurisation as it was.

6201. It is not quite of such good quality?—It is not of such good quality—that is exactly where it is.

6202. But the keeping quality would be very superior?—It goes off in flavour. It would keep butter if it was not frozen, I grant you, but it does not after being frozen. Danish butter, as you have had evidence, is pasteurised, but Danish butter does not undergo the freezing process, which acts on the quality of butter. The preservative preserves the butter after being frozen, and prevents it going off or deteriorating as rapidly as it would without a preservative.

6203. Then, to sum up, your opinion is that the moderate use of preservatives facilitates the trade of New Zealand?—I do certainly think so; but no one wants to use more than is necessary, and the trouble has been that there has been no limit.

6204. You would not go so far as to say it was essential to it, would you?—I say it is essential to it; it is essential to keeping butter in the finest condition, and, therefore, that means that it is beneficial to the trade.

6205. My question was whether it was essential to the trade—whether the trade between New Zealand and this country depended upon the use of preservatives?—I will not say it does.

6206. I do not want you to commit yourself?—Of course, it is a question that wants a little explanation. If the use of preservatives was prohibited, and by that the quality of New Zealand butter was depreciated, butter makers would still continue to make it, but they would send butter over here that might be considered on this market inferior, which would not give satisfaction to those using it, and, of course, would not realise as high a price.

6207. You have told us that the use of preservatives is not universal at present?—That is so.

6208. A great deal of butter comes to this country with nothing but salt in it?—Yes.

6209. Is that butter at present sold at a lower rate than butter with preservatives?—Yes.

6210. It is?—Yes, the butter that commands the highest price in this market—the brands most favourably known—the butter that has obtained the highest prizes in New Zealand competitions—is all butter treated with a slight preservative. That is thoroughly proved.

6211. Would your traders object to the obligation to notify the presence of preservatives?—I do not think so. Of course, I am not a trader, but I should not think they would have any objection to notifying. If there is a limit placed upon preservatives, and it is required to be notified, I have no doubt that it would readily be notified that all New Zealand butter, or Australian butter, or colonial butter was treated with it, as the case may be. But possibly a notification to the buyers that it is "New Zealand butter" would be sufficient. You see this is the trouble at present. I am often asked, "Can you tell me where I can buy good New Zealand butter"? I cannot. I do not know what retailer's or grocer's shop to go to to get it. It is sold as "choicest butter," and probably the buyers think it is fine English butter or Danish butter with no preservative. But if it were notified "New Zealand butter," then the inference would be at once that it is treated with preservatives, because if there was a limit fixed in this country on the amount of preservative to be used, then all butter makers in New Zealand, I believe, would use it.

6212. That is not a practical suggestion, because, although you can detect by analysis the presence of a preservative, you cannot ascertain by analysis the country of origin?—No, you cannot; but then you would not require to analyse it, for the notification would be sufficient for a consumer to know that it was treated in that manner.

6213. That implies a certain amount of knowledge on the part of the general consumer?—It is the same thing, I find, with the meat trade. For instance, you know very well in the best shops in the West End they sell New Zealand meat as English meat, and you cannot tell the difference. If that was notified many people would be prejudiced, and they would not use it. The same would occur with butter. If it was notified "New Zealand butter," those who are afraid of using it would not take it. It would be a safeguard, I think.

6214. Have you any figures to show the progress of the butter trade between New Zealand and this country?—The New Zealand butter export trade—that is, the factory butter—has now been going on for about fifteen years. In 1882 the Government issued a proclamation in the *Gazette* offering a bonus of £500 to any company that would establish a factory on the American principle for the export of either butter or cheese, and who would export twenty-five tons of butter or fifty tons of cheese, which would fetch in the London market or in the markets of the world a payable price.

6215. Forgive me, but if you would answer the questions a little more shortly it would save us trouble; we want to ascertain the extent of the trade?—I have it here in hundredweights. In 1883 the export in butter from New Zealand was 8,869 cwts.; five years later it was 29,995 cwts.; in ten years time it was 58,149 cwts.; and in fifteen years time it was 96,801 cwts.; whereas last year it was 102,479 cwts., so that you see it has been increasing steadily.

6216. Is it an all-the-year-round trade?—No, the butter from New Zealand commences to arrive here about December and continues till about May or June—about,

Mr. H. C. Cameron.

5 Feb. 1900.

probably, seven months in the year. It arrives here at the season when butter is scarce in this country.

6217. Now, can you tell us anything about the use of colouring matters?—Colouring matter, of course, is used merely, I suppose, to pander to the fancy of the consumer. I do not think it is used for any other purpose.

6218. To what extent is it used?—In butter colouring matter is applied to suit the demand of the consumer.

6219. So you have told us, but I want to know to what extent it is used?—In New Zealand we do not use it at all.

6220. That is a sufficient answer?—As I say, it is used merely to fill a demand. The quality of our butter is so rich that it is naturally sufficiently coloured. In fact, when I was in trade before I joined the New Zealand Government, inquiries were frequently made as to the cause of the dark colour of our butter. That is due merely to the richness of our grasses and to the climate.

6221. It is summer butter?—Yes.

6222. If it was an all-the-year-round trade your traders would probably adopt the same expedients as other traders?—Possibly, but in New Zealand you can run your cattle all the year round on the grass; you do not require to house them as you do in this country. Cheese, of course, is coloured in New Zealand to suit the requirements of the trade in this country.

6223. What are the substances used in colouring cheese?—Annatto is the colouring used.

6224. Exclusively?—I understand exclusively.

6225. Are there none of the patent colouring matters used?—I know of no other than annatto. It may be a few use what they have a fancy for, but I am not aware of it. Of course, it is understood to be perfectly harmless, but I myself do not think that colouring in any food is necessary. I do not think we should colour cheese; it makes no difference to the quality of it.

6226. (*Dr. Bulstrode.*) How much margarine is there imported from New Zealand?—None; the Government does not encourage it to be made.

6227. (*Chairman.*) Is that so?—The New Zealand Margarine Act is very stringent. Mixing with butter and colouring margarine is prohibited. We do not make margarine in New Zealand. In fact, when a deputation went to Mr. Long about margarine lately I produced the New Zealand Act, and showed them that it embodied exactly the clauses which they wanted embodied here, but which they could not pass.

6228. (*Dr. Bulstrode.*) Could you tell the Committee about what proportion of the butter coming from Greater Britain to this country comes from New Zealand?—Our New Zealand trade is small when you take the colonial trade. Of course, I cannot answer for any of the other colonies; I would rather confine myself to New Zealand.

6229. I will give you the figures for 1898. From foreign countries in 1898, 3,714,627 cwts. of butter and margarine were imported, and from Greater Britain 395,741 cwts. were imported, and you tell us that 102,000 cwts. came in last year from New Zealand alone, so that really the quantity coming from New Zealand is about a fourth of the colonial total?—I think it is small compared with the bulk.

6230. It is a fourth?—I have not here the figures.

6231. If you have 102,000 out of 395,000, that seems to indicate that from New Zealand a quarter of the colonial butter is imported?—Yes; but I thought you were taking Canada as well.

6232. (*Chairman.*) Canadian butter is colonial butter?—It is not so considered in the statistics. I do not know what term "Whitaker" may use, but in the London market the term "colonial" applies merely to Australasian butter and the term "Canadian" is applied to Canadian butter, although they are all colonial butters.

6233. (*Dr. Bulstrode.*) Of course I do not guarantee that these figures are correct, but I have read them from the current "Whitaker"?—I do not dispute anything that is said in "Whitaker."

6234. With regard to the amount of boracic acid which you wish allowed in butter, would you tell us the views of New Zealand in reference to that?—The views of those producing butter in New Zealand are that a limit should be placed on the quantity of preservatives that is legal in this country. As far as tests have been made to prove the quantity required, I have read you the tests. It has been proved that it is unnecessary to use a larger quantity than half per cent.

6235. Then you would be content with half per cent.?—Yes, and I might also point this out to the Committee that if you limit it to half per cent. for butter, you are doing as was done in the Margarine Act lately, when Mr. Long gave 10 per cent. while the trade said 5 or 6 per cent. was quite sufficient. You will be giving a good margin for this reason, that while half per cent. is the quantity permitted by law, yet if the half per cent. is the quantity applied, as was the case in this test that I have mentioned, the half of that half, or a quarter per cent., will be worked out in the working of the butter, so that in all probability the butter when received would only contain a quarter, or 0·3 or 0·4.

6236. You would be quite satisfied if a limit of 0·5 were made for butter in this country?—Yes.

6237. Why was it that the Agents-General for the Colonies objected to the prosecutions when 0·5 and 0·6 were said to be found in butter?—I think 0·7 was found in the Glamorganshire case. They objected to it because every County Council was a law unto itself, and had a right to say that if 0·7 is illegal in Glamorganshire, 0·6 might be illegal in the adjoining county, 0·5 in another county, and 0·4 in another county; there was no limit; in fact, a magistrate had no law to go upon; he had merely to use his own discretion as to whether it was injurious or not.

6238. Perhaps you know, as a fact, that the Agents-General did represent to Mr. Chamberlain that they objected to these prosecutions on the ground apparently that they had information that one per cent. was harmless?—Yes.

6239. But now you apparently have altered the position as regards New Zealand, is that so?—No, I do not say that one per cent. is not harmless, I say I still believe that one per cent. is harmless, but that it is advisable to have the limit as low as is compatible with necessity, and therefore I consider that half per cent. is sufficient, and half per cent. would be satisfactory to more who are trading.

6240. The Agents-General say: "It is stated that these prosecutions have been taken on health principles, and it is argued by local analysts that butter containing more than 0·5 or 0·6 per cent. of boracic acid is harmful to the consumers. But we have to inform you that the opinions of some of the very highest medical men in this country have been laid before us, and all of them agree that a much larger percentage of boracic acid than that laid down by the Welsh local authorities can be used in butter without being in the least way harmful to the health of the consumer. We are advised that 1 per cent. would be perfectly innocuous, but our main object in approaching you is to request you to be so good as to bring this matter before the President of the Local Government Board with a view to the exact amount of boracic acid which may be used in preserving butter being authoritatively defined, and that a uniform standard may be laid down for the United Kingdom"?—That is perfectly correct.

6241. You would be quite satisfied now if the limit were made 0·5 per cent.?—I would be quite satisfied if any limit was made so that we knew where we are.

6242. And any fresh preservative that might arise you would wish to be standardised?—Yes, certainly; then a person would know exactly how he stands, and he would have something to go upon. I certainly believe from all the evidence I have heard that one per cent. is harmless; still, you have had a great deal of evidence given which of course we cannot go past, and I am perfectly willing to rest on the tests that have been made purposely to discover what is the smallest quantity necessary, and therefore I would be satisfied with half per cent.

6243. And you would have no objection to its being stated that this butter is preserved with boracic acid?—No, I would have no objection whatever to that if it is considered necessary. I would rather, of course, as I say, have merely notified the source of origin. Let that be clearly marked on a card as margarine has to be labelled now. For instance, let the butter that comes from New Zealand be sold with a large label "New Zealand Butter," let Canadian butter be sold with a large label "Canadian Butter," let River Plate butter be sold with a large label "River Plate Butter," which is merely what you do with margarine.

6244. (*Chairman.*) How could you possibly enforce that?—You enforce having the label on margarine.

6245. That denotes the substance, not the country of origin?—That is so, still I think it would perhaps meet the case if the source of origin was notified.

6246. I submit it is impracticable?—It may be. I might say here that the New Zealand Government mentions a preservative in one of the Clauses of the Act: "No person shall sell or offer or expose for sale, or shall export or attempt to export any dairy produce which . . . . for any other reason is likely to endanger the public health. . . . . No person shall mix with or add to dairy produce or use in the manufacture thereof any extraneous ingredient of any description. . . . . . Provided that except in so far as is otherwise provided by regulations under this Act, nothing in this section contained shall be construed to prevent pure sugar, common salt, or any harmless, coagulative, preservative or colouring ingredient or constituent being used in the manufacture of dairy produce." They permit it, but knowing the feeling in this country they have reserved the right, in case it was objected to and made illegal to use it here, that "the Governor may from time to time, by Order in Council gazetted, make regulations consistent with the provisions of this Act for any of the following purposes: . . . . Preventing or limiting the use of preservatives or other ingredients in the manufacture of dairy produce." So that the New Zealand Government you see are very anxious to have their butter thoroughly sound and good, so that no objection can be taken to it. But from the tests they have made and the evidence they have before them they are satisfied that the use of preservatives to a small extent is not injurious.

6247. (*Dr. Tunnicliffe.*) Do you know at all as to whether the retail trade in New Zealand butter in any way differs from the retail trade of any other butter in this country?—No, I am not aware of any difference.

6248. Do you know how long it would be before the butter was in the hands of the consumer from the time of its arrival here—I mean how much must be added to your eleven week limit for the purpose of reaching the consumer?—The eleven week limit is taken as covering the whole time from the manufacture until it is placed in the hands of the consumer. Butter is sent down from the factory immediately it is made, and it is only held in a cold store in New Zealand until a vessel is ready to sail, then it takes six weeks on the voyage.

6249. That is quite sufficient; you have answered my question; eleven weeks is the whole time?—That is the fair average. I think that is about the time.

6250. Would any complaints with regard to the keeping power of New Zealand butter come under your notice?—Not directly. I have heard of complaints, and my attention has been drawn to them.

6251. Can you tell the Committee whether the complaints that you have had your attention drawn to affected butter with a preservative or butter without a preservative in it?—That I cannot say, because I do not know personally the different factories that use and do not use preservatives in the colony.

6252. (*Professor Thorpe.*) The Report from which you have quoted is one addressed to the Department of Agriculture of the New Zealand Government by a series of their inspectors?—Yes, that Report is by the Chief Commissioner.

6253. Which Report is made by the Chief Commissioner?—That Report giving those tests.

6254. Who is that?—At that time it was Mr. Sorensen.

6255. Was that gentleman born in New Zealand?—No, I do not think so.

6256. Is he a Dane?—I cannot tell you; I do not know Mr. Sorensen personally.

6257. Has he left New Zealand now?—He has left New Zealand.

6258. Do you know where he is?—Somewhere in this country, but where I cannot say.

6259. This, of course, is one of several Reports that he has made?—That is one of several Reports, but that was made the year that he was Chief Commissioner.

6260. How long has Mr. Sorensen been in New Zealand?—I do not know how many years.

6261. Has he had any important influence in the conduct of your operations in butter producing in New Zealand?—I cannot tell you, I merely give you the Report as I get it; I do not know anything about Mr. Sorensen.

Mr. H. C. Cameron.

5 Feb. 1900.

6262. Are you aware that in many of his reports he has urged the necessity of legislating against the use of any preservatives in butter except common salt?—Yes, I have; that makes his Report of the tests all the stronger, I think.

6263. In the Report he tells us that he caused a list of questions to be issued "to fifty of the most prominent butter makers and exporters with the object of eliciting their views as to the financial benefit of using preservatives"?—Yes.

6264. From those fifty leading butter makers thirty replies were received; of those thirty replies eighteen were opposed to the use of preservatives and only six were in favour of their use, the others being neutral?—Yes.

6265. Taking the actual output of the several classes it appeared that of those who were in favour of the use of preservatives the amount was 1,500 tons; of those against the use of preservatives the amount was 1,480 tons; and of those who were neutral the amount was 925 tons?—That is so, as I understand from the Report.

6266. Then, on this basis, the balance of evidence denies the necessity for using anything but common salt?—That is so.

6267. That is the general evidence of the trade collected in New Zealand?—Yes, that was the general evidence.

6268. It appeared that out of the 925 tons exported by the neutrals—those who declined to express any opinion—as a matter of fact 725 tons were not treated with preservatives?—Yes.

6269. Then the evidence of the trade so collected was distinctly against the use of preservatives?—Yes.

6270. Now we come to the experiment—that is an isolated experiment?—Yes, purposely made to prove whether it was beneficial or not.

6271. An isolated experiment made upon the results simply of one churning?—Yes.

6272. And on, therefore, comparatively very limited quantities?—Yes, certainly.

6273. Therefore, you draw a somewhat wide generalisation upon the limited basis of one experiment made upon a comparatively small quantity of butter?—Yes; I am merely going by that experiment that was made purposely to prove whether it was beneficial or not, and made by those who were, of course, rather against it.

6274. When we examine the details of the experiments we find they are not altogether very definite in their teaching. All, however, that you do deduce from them is that so small a quantity as a half per cent. is sufficient when combined with 3 per cent. of salt; that is the teaching of the experiment?—Yes.

6275. Is there any reason, in your judgment, to suppose that this experiment is so convincing as to avoid or obviate the necessity of any further trials?—No. Further trials have been made, but I have not got the particulars as I have of that one. I will probably get them, but I have not got them yet. I only gave you that because it is a published one.

6276. Are you in a position to say generally what these further trials have led to?—Of course, I am talking merely from what I understand to be a fact, the further trials have led, as I said, to prove that the use of preservatives to a small extent is beneficial.

6277. But you are not able to hand in any particulars?—I cannot.

6278. Your Government has not given you any further details, in view of this Committee?—No, I have not got them; in fact, I have had no communication whatever with the Government in view of this Committee.

6279. The Chief Inspector has had occasion more than once to express the opinion that pure milk is still wanted in New Zealand?—That is what I said; that is what the Government is aiming at.

6280. There are still, in his judgment, factories at which the milk is delivered in a uniformly poor and dirty condition, and in his judgment this is a state of things for which there is no excuse—he so reports, does he not?—That is so. The Government is trying to work up the dairy industry.

6281. Now, I put it to you whether it is not conceivable that the indications given upon this single experi-

Mr. H. C. Cameron.

5 Feb. 1900.

ment, of which you have told us the results, may not possibly be affected by the condition of things which the chief inspector deprecates?—I scarcely follow what you exactly mean.

6282. I put it to you whether the results of the test, the single experiment, that was made may not possibly be affected by the condition of things which the chief inspector deprecates—namely, the influence of poor milk and the influence of uncleanly conditions?—The test was made from the same milk, and the conditions were similar; the butter was all of the same making. It was the same butter. The test was merely to see whether the preservative was beneficial or not.

6283. But is it not the fact that if there had been something in the nature of taint or uncleanliness—something in the nature of a bacillus which affected the decomposition of the milk—that even that small quantity of boracic acid might have inhibited its effect?—Boracic acid does not destroy taints as pasteurisation does.

6284. No, but the effect of that boracic acid would be to protect the butter from the influence of foreign uncleanly material in it which would have its effect upon causing the butter to go off, would it not?—It would preserve it, certainly.

6285. It would preserve it from the effect of those germs, whatever they may be?—I suppose it may be, if you follow it up, that the germs would be more pronounced afterwards; it prevents the decomposition, you may say, of any food—is that what you mean?

6286. I mean that this small quantity of boracic acid might have been the agent which prevented the influence of the foreign substances which might be present in the milk such as the chief inspector deprecated the use of?—But he is talking generally of the milk throughout the country, the same as you hear mentioned by people: "Oh, yes, Danish milk is in a dirty state, and they pasteurise it accordingly"; but that does not prove that this particular test was made from dirty milk.

6287. Does it not?—I do not think so, and I don't think that in that particular factory such milk would be used for the test, knowing that was made by a Commissioner who was opposed to the use of preservatives, and whose feeling was against them and in favour of pasteurisation. I think that he would try all he could against it, but then he admits that although he was personally unfavourably disposed to it, the test rather convinces him that it is advantageous to use it.

6288. I want to point out to you from the general conditions which obtained in New Zealand, which he deprecates, that the results of the experiment might have been fallacious on account of those conditions entering into it?—Of course they might have been. As I say, I am not an analyst and I merely go on general trading grounds.

6289. Is not Mr. Sorensen's comment on this experiment the following: he is loth to base conclusions on the result of a single experiment, especially when, as in this matter, many previous experiments have given conflicting results?—Yes. Mr. Sorensen, as I told you, was opposed to it, and he is naturally talking as strongly against it as he can in the face of the result of the test.

6290. I understand that in New Zealand the Government has not felt itself in a position to enforce the clause of the Dairy Act, which compels the cooling of milk?—I do not know whether they have enforced it or not, but I know that the Act is very stringent regarding it.

6291. The words in the report are: "The Department has not enforced the clause of the Dairy Act compelling the aëration of milk on the farms." By the aëration of milk you mean in New Zealand its cooling?—Yes.

6292. That is so stated in this report?—Yes.

6293. Mr. Sorensen had already in several reports expressed his opinion of the value that pasteurisation would be to the dairy industry of New Zealand?—Yes.

6294. He says: "While perfect milk needs no pasteurisation, imperfect milk cannot be successfully treated without it, and until every individual supplier brings only perfect milk to the factory pasteurisation must be regarded as a necessary part of the butter-maker's art." Do you agree with that?—Yes. I think I said in the first part of my evidence that pasteurisation made an average butter. It destroyed all taints, whether bad or good. The Act, as you see there he remarks, is perhaps not carried out in its entirety, seeing that the trade is in its infancy; but the Government is anxious that the very finest butter should be made, that is, butter better than pasteurised butter; that everything should be cleanly, and that the proper flavours only shall be in the milk.

6295. The Chief Inspector points out that "the Danes pasteurised 97½ per cent. of their output last year," and in his opinion they did not do it, as he expresses it, for fun; "they did it because it paid them. And if it pays them"—he goes on to say—"with their well-tutored milk suppliers and clean milk, it will pay us with our comparatively inferior milk." That is the advice tendered by the Chief Agricultural Inspector to his Department. Do you agree with him in that recommendation of pasteurisation?—I believe that pasteurisation brings up the average quality of the butter, but with pasteurisation you never get the finest quality of the butter. You must remember the Danish butter, as I have already said in my evidence, is put on the market here a few days after it is made, while New Zealand butter has to be frozen for weeks, and the action of freezing is rather detrimental to the keeping qualities of the butter when thawed.

6296. Are you aware that Danish butter is frequently sold in this country when it is from a fortnight to three weeks old?—That is, comparatively speaking, new.

6297. It bears a certain proportion to eleven weeks, does it not?—Yes. But, as I say, we have to freeze our butter, and that I grant does depreciate it if there is nothing to preserve it after coming out of the freezing chamber. You find the same with our meat; the action of freezing on our meat is not to depreciate the quality or tenderness of it, but to destroy the appearance of it after thawing. I am not chemist enough to say what the actual action of frost is, but I know the effect on the appearance of the meat. I know the result of it on butter; it destroys the keeping quality when thawed.

6298. You are aware that Mr. Sorensen is not alone in his recommendation of pasteurisation?—I quite understand that.

6299. The other inspectors concur with him in that recommendation?—Yes.

6300. Mr. Robertson, for example, says: "From what samples I have seen of butter treated in this manner I am strongly impressed with the improvement in quality" which results from pasteurisation?—I grant you that it brings the average of the butter up, but it prohibits you making the finest butter, which we are trying to aim at in New Zealand.

6301. Of course it is conceded that in the case of perfect milk pasteurisation is not required?—Yes.

6302. But I am afraid perfect milk is an ideal fluid, is it not, and must for many years be?—We are striving for it, however.

6303. The general conclusion of this report based upon all that the various inspectors put forward is that there is still room for improvement in many of the New Zealand butters?—Yes, we are in our infancy as far as butter-making is concerned.

6304. But inasmuch as you have proved that you can turn out a first class butter from a certain percentage of factories, it is the judgment, of course, of your representative and official people that every effort must be made to bring up the rest to that high standard?—That is what we are striving for.

6305. One of the conditions which they lay down as required to bring up your butter to that general high standard is pasteurisation?—Yes.

6306. In their statements of what should be done to improve the quality of your butter there is no recommendation to use preservatives?—Because, generally speaking, they are alluding to the butter as it comes under their notice in the colony, not as it is placed on the market here after coming out of the freezing chamber.

6307. Pardon me, all these inspectors, or, at all events, a large proportion of them, concern themselves with the shipping and with the transit of the butter?—That is so, with the shipping and the transit, but they have not taken into consideration I think the keeping qualities of the butter when put on the floor of the merchants' stores and on the counters of the retailers in this country. Pasteurisation, of course, I need not repeat what I have said, brings up the average of the butter. I may point out that the experiment which was made, and which you allude to, was made on the basis that the butter would be as it is in this country after eleven weeks' keeping, Mr. H. C. Cameron.

5 Feb. 1900.

and after being treated in the same manner as it would be when put into the retailers' hands here.

6308. But I must also point out that the experiment has all the possible fallacies which attend a single observation?—You mean that more experiments should have been made?

6309. Certainly?—They have been made, but I have not got them in print, and I have not got the reports of them here. I merely know that they have been made, and that they bear this one out. The reason the butter makers have not used the preservative more extensively is that they have been afraid to use it in the face of the objection taken to it by many in this country. They do not wish to have prosecutions against their butter. I need hardly repeat what I have said, but it is proved that the finest butters that are sold on the market here are those that have a slight percentage of preservative in them.

TWENTY-FIRST DAY.

Wednesday, 7th February, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. ROBERT GIBSON, called; and Examined.

Mr. R. Gibson.

7 Feb. 1900.

6310. (*Chairman.*) You are salesmaster of the Public Creamery Market, in Limerick?—Yes.

6311. You have had a considerable experience, I suppose, of the butter trade?—Yes. I represent also the firm of Pearson and Rutter, of Manchester and Liverpool. I have had fully forty years' work at the butter trade.

6312. We understand that the fresh butter trade in Ireland depends at present a good deal on the use of modern preservatives?—I believe it depends entirely on it.

6313. Why do you believe so?—Because wherever it has been tried without the preservatives it has proved dissatisfactory to the people who have got the stuff forward. We have tried it again and again without it. Here is a private letter from a gentleman——.

6314. I would rather take your evidence, please?—This gentleman runs a private dairy, and makes some of the finest butter I ever saw. He tried it without preservatives, and got into the greatest trouble with it. As soon as ever he used preservatives his customers were thoroughly pleased. I have several letters of the same sort. I have tried hundreds of experiments, and I find that the best saltless butter made will not keep, to be thoroughly good and palatable, more than a week at the very outside. That does not do for distribution. For instance, if I send butter from Limerick to Dundee (and I do send a lot of saltless butter there), it leaves on the Friday by the Glasgow boat; the gentleman in Dundee will not get it before Tuesday morning; he then distributes it to his customers during the week, and they keep it, and must keep it in their houses for some time. With a small quantity of preservative that butter will be absolutely good and sweet; it will be as good at the end of a fortnight as it was the day it was made. Without the preservative, it will be absolutely bad. It is not only necessary for the absolutely fresh trade, but for the salt butter trade also, because we find that Irish butter is not treated as Danish or Normandy butter is.

6315. Do you mean in the manufacture?—No, I mean here, in England. We have always had the name of having keeping butter—that Irish butter would hold for a month and for two months. I have sent butter to a gentleman—and do send it to him regularly—at Grantham; he gets a four months' supply from me, and he tells me the last of it is as good as the first of it.

6316. Do you attribute that to the use of the preservative?—Certainly. I make it, and have made it, specially with a preservative for him; in fact, any butter that I have any control over is all made with preservative.

6317. Is there anything in the quality of Irish butter itself which makes it a better keeping butter than others?—I do not know that. It has always been considered as having a better keeping quality, and it has always been used as a keeping butter. If we give them two or three consignments that will not stand there are at once rows about it. Whereas the Danish butter and the Normandy butter are used promptly, because they know that after a fortnight, or three weeks at the outside, Danish butter, if it has missed two markets, has to go for next to nothing; say, butter that was worth 120s. will be sold, it may be, for 80s. The firm that I represent get hundreds and hundreds of casks of Danish butter every week, and I have had large opportunities of seeing it perfectly fresh and seeing it after a short time. Undoubtedly Danish butter is supposed to keep, and it keeps long enough for quick distribution, just like Normandy butter does, but it will not keep in the way they expect our Irish butter to keep. The great difference, you know, between the make of Irish butter and the make of Danish butter is that the Dane makes fresh butter all the year round, keeps on having new milch cows coming in in the winter, and supplying a freshly-made article always. Unfortunately the greater part, well, 90 per cent., of our farmers calve their cows early in the spring, and our butter is made in quantity from April until the end of November. For instance, in 1898 I estimated, after a careful gathering of statistics during the year, that in that year we made 80,000 tons of butter in Ireland from the beginning of April till the end of November; there would not be more than about a thousand tons made between December and the beginning of April because the milk of nearly all the winter cows in Ireland is very valuable at that time for making condensed milk, and goes for that, or is used as a new milk in the towns, so that our make of butter from the 1st December to the beginning of April, it may be till the 14th April, is a mere bagatelle.

6318. Are you speaking from personal acquaintance with the Danish dairy industry?—Yes; I know perfectly well that we get sometimes 400 or 500 or 600 casks of Danish butter into our hands, and during the winter months——

6319. Pardon me. When you say that the conditions of the Irish farmer and his practice differ from those of the Danish farmer are you speaking from personal acquaintance with the Danish farmer; have you ever been in Denmark?—No, I have not. I have been in Sweden in February, and seen them making butter and milking apparently as much as at any time of the year. I have never been to Denmark, but I know they do it in Sweden, and in the winter I know that we get a larger quantity of both Danish and Swedish butter over for the firm which I represent; in Manchester and Liverpool—we get more in the winter a great deal than we do in the summer.

6320. Does the Irish farmer keep his cows out in the winter?—Some few of them that have a good deal of shelter; as a rule they keep them in the yards and just let them out for two or three hours in the day for a walk, that is the in-calf cows. All the two-year-olds and those

Mr. R. Gibson.

7 Feb. 1900.

sort—all the young stock—are kept out except when there is snow and frost. The in-calf cows are brought in whenever it gets cold; they would be let out in December, and they would be in in such weather as this altogether it may be, except for half an hour or an hour's walk.

6321. You have spoken of the supply of milk to the towns as interfering with the supply of milk for butter-making in the winter?—Yes.

6322. You say that the Irish farmer sends his milk to the towns?—Yes.

6323. Are you aware that the Danish towns are fully supplied with milk also?—Of course, but what I say is that we do not calve a sufficient number of cows in the winter to do anything more.

6324. Is there anything to prevent your doing that?—There is nothing whatever to prevent us doing so—nothing.

6325. Then I understand that if the Irish dairy trade were to undertake the supply of butter throughout the winter the farmer could comply with the requirements of the trade by supplying milk for butter?—Certainly. If the Irish farmer were as educated as the Swede and the Dane he could, and he would calve his cows in winter. For the last twenty years I have been dinning it into them as far as ever I could.

6326. Have you made any progress?—I should say that we have now about twenty times as much winter calving as we had twenty years ago, and our winter butter, where it is made well, fetches more money now than the best Danish winter butter.

6327. Your winter butter being absolutely saltless?—Some of it is salted and some of it is saltless. Almost everyone who gets saltless butter gets salted butter at the same time. I do not know any trader to whom I send saltless butter that does not have some salt-cured also.

6328. Is there any preservative in your salt butter also?—Every bit of butter that I have been able to control for the last seven or eight years is always made with a preservative. I believe it is absolutely necessary for meeting the present taste in England. They want not heavily salted butter; they have learnt that that is very unpleasant, that it makes them want to drink a great deal, and they want a mild butter instead. I myself eat nothing but saltless butter, made with a pound of preservative to 112lbs. of butter, and the result is that for the last three or four years since I began that, between meals I never require to drink anything.

6329. Are you aware that that percentage of preservative is considerably higher than has been found necessary in conveying slightly salted butter from New Zealand to this country?—I am quite aware that it has been said to be so, but I know perfectly well, because I have had it tested, that that percentage, 1lb. to 112lbs., analyses out 0·8. That will keep fresh butter; I have often had it and put it by for a month, and had it as sweet and as nice at the end of the month as it was in the beginning.

6330. What percentage do you put in salt butter?—I put 1lb. of the preservative with 3lbs. of salt to 112lbs. of butter. That is what I recommend all the makers to do, and that is what I do in the case of the butter that I make up myself.

6331. Why do you find it necessary to put a larger proportion of preservative in Irish butter than the New Zealand manufacturer does in order to send it to this country?—In the first place, in New Zealand they have a Government which has done everything possible to teach them how to make their butter correctly. They have a Government that has got cold stores for them at all the shipping ports and points where they can send in their butter. They have a Government which has arranged that they should have refrigerating places in the steamers to keep the butter; and the butter is brought over here under the very best possible circumstances. Irish butter, on the contrary, is brought over here under the very worst possible circumstances—exposed in our railways and with no public cold stores. There is one private cold store got up by a company, but no Government attempt. Irish butter is put into waggons, carried at all sorts of hours of the day, carried under the burning sun, without an attempt at refrigeration; thrown on to the quays at Waterford and Cork and Dublin; exposed in every way possible; put into steamers without any attempt at refrigeration; landed at your English ports and badly handled by your English railways, because there is absolutely no one to look after it.

6332. Could you give any proof of the bad handling of butter by the railway companies?—I have had hundreds of cases myself, and here in London one gentleman to whom I had been sending butter *viâ* Milford wrote to me when I sent him a couple of lots by the London and North-Western Railway, and said: "I have got your butter, part of it most fearfully badly damaged," and the next lot he said: "Do not attempt to send it again by the London and North-Western." By some mistake in a week or two afterwards another lot was sent to him by the London and North-Western, and he says: "I got one part of it damaged and the other part has not arrived yet." Three or four days afterwards it arrived, and he says: "If there is no other way of getting butter but by the London and North-Western, I would never have another package of butter from Ireland." I have had hundreds of cases.

6333. How long ago was that individual case?—That was some time last year—in the middle of last year; I do not mean 1899, but in the middle of 1898.

6334. Was any claim made against the railway company?—I do not know what claim he made. I suppose he made a claim and got it. I expect, you know, that he refused the damaged butter unless he was allowed a claim. I made no claim, because he paid me, and he paid me in full. I have had plenty of cases—it is not one, but dozens of them; complaints of the heads stove in and all sorts. We have, as I say, absolutely no protection. If Danish butter were as badly handled——

6335. When you say you have no protection, you have a claim against the company?—Yes, to get butter out of a dog's throat. I have had claims against the company admitted, and got them paid after fighting them for two years. Why, half the claims we have we do not press—we could not be bothered with pressing them.

6336. Is that good business?—It is—to press them and to go to law, and to waste your time going down to the courts, you lose more than you gain, you lose more than your whole claim, you lose it half-a-dozen times over. We do press it sometimes. But here in England, if there is anything done wrong with Danish butter, for instance, or with Swedish butter, Mr. Faber is down on the railway company at once, or the Swedish representative is down on the railway company at once; they go to the railway company at once, and they are made to sit up, and the result is that, as a matter of fact, if you go into any seller and see Danish butter or Swedish butter, you will see it is landed like new pins. But if you see Irish butter landed, although we bag it—we bag nearly all the butter that we send, that is, we put canvas wrappers round it—you will see it with the lids broken in, the hoops knocked off of it, and even casks sometimes dirtied through the bags.

6337. Could you give us specific cases?—I have had lots of cases.

6338. General charges against railway companies, as some of these are, you must be aware are not——?—I did not bring any one specific case—I could give you dozens of them.

6339. You said a minute ago you had hundreds of them; now you have reduced it to dozens?—I could give you hundreds of them.

6340. I ask if you could give us one?—Yes, I will give you one—one only the year before last brought into my market. There was a couple of tons of butter in a waggon, and when the waggon was opened the stench out of the waggon was so great that we had to have it run right away up the tramway out of the market; they had shoved a couple of tons of butter into the waggon.

6341. Which company is this?—The Waterford and Limerick Railway Company.

6342. That is not an English railway company?—No, that is not an English company, but this is just a thing that struck me. They had run a couple of tons of butter to me from somewhere out of the west in the country in a waggon that was stinking with stale fish, and which they had evidently had fish in where the thing leaked about. We could not understand it, and so it had to be shoved right away up the tramway and the butter got out as quickly as possible and then brought down into the market.

6343. Has there been any improvement of late years in the railway traffic either in Ireland or in this country?—I do not know that there is any real improvement. There certainly is no improvement in giving us any protection from the heat of the sun and the heat of the weather—not the slightest.

6344. You mean that there are no refrigerating cars?—And no attempt to protect the butter at the stations, no attempt to protect the butter on the quayside in hot weather—not the slightest. Anyone can see it at any of the shipping ports or at an out-of-the-way station, for instance. I do not know about the Cork station, but at our station our carts are drawn up there, and there may be a lot of twenty carts all loaded with butter with absolutely no shelter. That butter will be going away say by the 4 or 2.10 train down to Waterford for the Waterford and Milford boat. There will be twenty carts there in a line, the sun blazing down on them with absolutely no protection for them, waiting while waggons are brought up. Sometimes my men are kept there for an hour waiting before they can get their butter into the waggons, and then the waggons are all exposed and they run on a siding without any cover over them. The butter is delivered there into the waggons on an open siding.

6345. That is on the other side—in Ireland?—Yes, that is at Limerick, where we ship it.

6346. And there is no improvement?—There is no improvement whatsoever in that way.

6347. The Irish butter trade has largely developed of late years, has it not?—Yes, since we got what we call the creamery trade it has very largely developed.

6348. Have the railway companies taken no steps to meet that?—I know of none. As I tell you, my experience is that they handle the traffic as badly as ever they did.

6349. On both sides?—On both sides.

6350. Are you aware that large quantities of butter are made in creameries in this country without the use of preservatives?—And why not? They go into consumption in two or three days. There are large quantities of creamery butter made in Ireland without preservatives, too, and I have known great faults found with them very often for not keeping. I know one very large buyer, a gentleman who will buy about 50 or 60 tons a week. I know that last year he refused to buy butter unless there was a preservative in it because he found it keep so badly; he is a tremendous buyer of butter.

6351. Is it generally known to your consignees that a preservative is in the butter?—So far as I am concerned, at all events, I have made it as plain as it possibly could be, and even to private people, because some private people say they cannot get Irish butter or good butter here to buy in a retailer's—they are friends of my own principally; I send them butter by post, and I send butter to some of them by goods train, and they tell me distinctly that they like the butter with the preservative in it, and that it keeps. They all know that there is preservative in it.

6352. In that case would you see any objection to requiring a declaration as to the presence of a preservative?—Not the slightest objection. I am perfectly satisfied that the preservative is a great deal more wholesome than salt—from my own experience, perfectly satisfied. I know this, that when I used to eat salt butter for my breakfast and then had to go down to the market and taste a lot, I had to come in two or three times between breakfast and dinner to get something to drink. You need not smile—it is not strong liquor, because I am a total abstainer for the last twenty-four years. But I used to have to do that. I could not do without getting two or three drinks between 10 o'clock and my dinner hour at 2. Now that I eat nothing but saltless butter cured with preservative I never think of wanting anything to drink between meals.

6353. No, I can quite understand that?—Never. I believe that for the health of the community and for the pockets of the community the use of preservatives in butter has been of the most immense advantage. You know this, we must have it if we produce 80,000 tons of butter, as we did in a good year—we only produced about 66,000 tons of butter last year, but in 1898 we produced 80,000 tons, at least that is my estimate, and everybody almost who thoroughly understood the trade and knew it said that I was estimating over 20,000 tons less than what we produced in 1898, but I was absolutely certain that we did produce up to 80,000 tons. Our ordinary make would be about 70,000 tons, and last year, on account of the very bad May, our produce was only about 66,000. Suppose we have a good year, and that there are 13,000 or 14,000 tons extra produced in the hot season, what is to be done with it; who is going to buy it unless it is made so that it will keep? No one will touch it except they buy it at the price of confectionery stuff, 55s. or 60s. a cwt., if they do not think it will keep. You were told here by a witness that nobody thinks of keeping butter now. It was only last week I got a list in from the mountains of, I suppose, twenty or twenty-five names of farmers, with their different list of firkins that they have kept of butter made last August, September, October, or November. I bought only one lot of it this year; last year I bought hundreds of firkins that had been made in August, September, October, and November, and I bought them in January and in February.

Mr. R. Gibson.

7 Feb. 1900

6354. That is slightly salted butter?—It was a fairly salted butter, I suppose 5lbs. of salt to the hundredweight—that is 112lbs.

6355. And any preservative?—Some of it was made with preservative. I found the owners very stiff about that, and did not get at the price I wanted. They fetched 3s., 4s., 5s., and 6s. a firkin more than the butter that was not made with preservative.

6356. The butter which had preservatives would have less salt in it, would it not?—It would have less salt or it would have a strong appearance, at all events, of having less salt in it. If you put 3lbs. or 5lbs. of salt with a pound of preservative in your 112lbs. of butter, and you put exactly the same amount of salt without the preservative, the butter that has the preservative in it will have a milder flavour than the butter that has none. Why I cannot tell you, but that is a positive fact.

6357. When we talk of preservatives I am assuming that you are referring to boracic compounds?—Yes. Boracic acid and borax are the base of all the preservatives. Of course, there are two or three other ingredients in very very small amounts—put in for special purposes—but the boracic compound is the base of everything; 95, aye, 99 per cent. of all the preservatives, I suppose, are made from boracic acid. But the very great difference between our make and other makes is that our makers, as a rule, are not educated. You see in Denmark and in Sweden they are not only now educated, but they have been educated for years. In Denmark, only the size of Munster, £72,000 a year is spent in the support of agricultural teaching, and the people are thoroughly educated. Our people are not thoroughly educated. We have a few, of course, thoroughly educated, who are making magnificent butter all the year round, but the run of our people have had, it may be, three months at a dairy school. They come away with their certificates, they know how to do things when everything is exactly right; but instead of being taught as they are, as I am informed, in Sweden and Denmark—taught for a whole year, or two years, so that they have to meet every sort of weather—when something goes wrong they do not know what has gone wrong, and they blunder and bungle over it, and they really have no one to ask to come and set them right. In the foreign countries they can send for the Government instructors at a very small fee, get them down to their dairies, and have the thing set right at once. Now, I will give you an instance of that if you will care to hear it. It is a most curious instance. A gentleman friend of mine, T. D. Atkinson, of Glen William Castle, started a creamery for himself and his tenants, and for the first year he sent me in the most magnificent butter that could be seen. The next year he sent me in the most execrable rubbish—as soon as the new season opened. I immediately wrote to him and told him his butter was altogether wrong. He told me that it was the same dairymaid as last year, and that they were doing everything exactly as they had done it before. I said, "You are not doing everything the same as before; anyway the butter is utterly wrong; I cannot sell it, and my advice is you let me put it into Mr. Shaw's ice-house" (who kindly permitted me to use it) "and leave it there for two or three days, and see the result." He came up and saw the result. You could put your hand round between the butter and the casks that had been firmly packed, the butter touching the casks before, and when I bored it for him, there was a lot of water and milk. Well, of course, he thought it was altogether my fault, and that I ought to have been able to sell it. I told him: "That is no use to me, and as long as you make it like that I would be obliged to you to send it somewhere else. I cannot sell it, and I will not try to sell it." So then he tried some other markets, several other markets, and he found that he got miserable prices, and that he really must be wrong. Then he wrote to me: "For God's sake, come out and tell me what is wrong." I went out. He had this woman, a certificated woman from the Cork Dairy School, who had made him

Mr. R. Gibson.

7 Feb. 1900.

splendid butter the year before. I went out. I saw her putting her cream into the churn. I tasted it. I asked her, "Are you going to churn that?" "Yes, sir, that was yesterday morning's skimming." So I said no more. She put it in. The cream was not fit to churn at all; it was not half ripe. He had a Holstein churn, and I counted the revolutions, and she sent it going at 75 revolutions a minute. I asked Mr. Atkinson, "Does she always churn at that pace?" He said, "I think so." I said, "All right." She went on and churned for a certain time. Then she stopped the churn, and as a result—a natural result—she had a lot of butter gathered in lumps, some of the cream not really churned at all—that is, not really properly churned. She washed her butter, she brought it out and put it into a tub, and she put it on to the table, and she began to work it. Seven revolutions of the table is quite sufficient for any properly made butter to take all the water that you want out of it. I counted, and she made 27 revolutions of the table, because she saw that she was not getting the water out, and instead of getting the water out she was really knocking the water that was in it thoroughly into it, breaking up the globules of butter and breaking up the globules of water, and making them stick together. So when she packed it I went out to Mr. Atkinson and I said, "This woman must be mad." He said, "Look here, here are her discharges and certificates and everything, and she made beautiful butter last year." "She did," I said, "but she has now churned unripe cream; she has churned it half as fast again as she ought to churn it, she has over-churned it, and then she has worked it in the most preposterous way." He said, "I would be afraid to say anything to her; she would only kick up a row." "Then," I said, "get rid of her as fast as you can. Have you got any of her butter made in the last two or three days?" "Yes." We went in and saw it. It was that full of buttermilk and water—as it naturally would be—that it was absolute rubbish. He did get rid of her, and the dairy is turning out the best butter that comes into Limerick, and often gets 2s. and 3s. over the top price now that they have got an educated person.

6358. From that you deduce that that woman had been imperfectly educated?—I not only know that she was, but that the greater part of them have been imperfectly educated.

6359. Was she three months at the Cork Dairy School?—I think she was three months at a dairy school.

6360. Do you think she would have been any better if she had been three years?—I think so, because she would have seen all sorts of changes, and she would most likely have got ideas of how things are done wrong. That is the unfortunate thing about our butter makers. They know how to do things right when everything is right, but when a thing is wrong they have not the faintest idea what to do. Now, I had at one time in my store a man as good a butter maker as ever could be a dairyman. I was taking in a lot of cream in the winter from dairies that were not able to make it up properly—from those very creameries that did not know how to work it in the winter. One Saturday night a lot of cream came in. I saw that it was fully ripe, and I said to the man—it came up about six o'clock in the evening—"you must get that churned to-night and get it in at once." He got it in the churn. I went out to my tea, where I stayed about 35 minutes. I came down; I did not go into the factory, but I went down to the store, my office. The man said, "We have not got the butter yet." I asked, "What are you running it at?" "Forty-five." I said, "Run her up to 65, and if you have not got butter in five minutes let me know." He reported, "There is no good butter yet; we have run her fully 40 minutes now." I said, "Take the head off, and I will be out." I went out immediately and looked into the churn. I said, "She is fast asleep. You ought to know a sleepy churn." "Never heard of such a thing in my life, sir." Though he had been a man making butter for four or five years. Very well; I just took the steps to wake it up, and I had a sit down, and in 10 minutes we had a beautiful churn of butter. The man came to me, "We have the finest churn of butter I ever saw." I said "Sleepy cream always makes very nice butter when you put it right." I went out and I saw it. I said, "Draw that butter." He drew the butter, washed it, and put on the drainer. "Go and get your tea, and when you come back it must be finished." He did so, and when he had everything finished he came, and he told me, "We have got the grandest produce you ever saw." I went out, and I said, "How many gallons of cream did you put in?" So many, he said. "Why, you fool!" I said, "you've got a third more butter there than was in the cream; that will warn you on Monday to make it right." He replied, "It is the most beautiful butter that could be seen, sir." This was a man that was a thorough good dairyman. Then I said, "It has about a third or more water in it than it ought to have, and you will see on Monday you will have to take it out." That sort of thing happens to hundreds of our people.

6361. We are getting a little far from the subject of our Inquiry. I did not like to stop you; but the impression you give is that your people are not sufficiently educated in butter making. If they were better educated, would they be more independent of the use of preservatives, or would you still have to rely upon preservatives?—I would still rely upon the preservatives; but I believe, of course, if they were thoroughly educated and if we had cows calving all the year round, and an even supply of butter, and if our butter was treated in England as the foreign butter is, that then we might do without preservatives. But I say that under the present circumstances it is absolutely impossible for us to give you butter that will please you and to give you butter that will keep, made as it is made—a season make. It is absolutely impossible to do without the preservatives. You were told that Danish butter comes here with 1 per cent. of salt. Now, that is perhaps the fact with regard to some very infinitesimal portion of it. When I saw that statement made before this Committee I got a sample of the very mild Danish, and I sent it to Mr. Walter Thorpe, our analyst in Limerick. He immediately sent me a return. "This is a very mild Danish," he said. "1·90 in it." Now, I know that a great deal of the Danish that goes north, at all events to Manchester and Liverpool, is made with 3 or 4 per cent., and I know that in Newcastle-on-Tyne they would not take butter with 1 per cent. of salt in it. It is nonsense to say it.

6362. Who would not take it?—The Newcastle-on-Tyne people; they like butter with a little touch of salt in it, and in Manchester the same way. I got a letter from Mr. Thorpe this very morning, saying that he had got over from London a sample of one of the mildest Danish dairies coming into London, and it contained 1·59 of salt; that would mean that it was made with at least 2½ per cent. of salt when they were making it, because, of course, salt goes a bit out of butter you know.

6363. In the form of brine?—It gets away out of the butter. I know that, because I have very often had it analysed for salt, and what I knew I put in was not found there in a fortnight or three weeks, especially if it was kept for any time; it showed a great deal less salt than what we put into it. We made not one, but two very careful experiments in Limerick about preservatives. We got in from a very capital farm a lot of cream, and we made this experiment before half-a-dozen gentlemen; we churned the cream, we took out the butter, and we divided it into four equal portions. We made one up on what is called the dry system, and we used only dry salt in it; we made up another with a small amount of pickle and fair amount of salt; another with the same proportion of salt with a fair amount of pickle, and we made up another with a larger amount of pickle and a rather larger amount of salt—a proportionate pickle, or water rather, to keep the salt in perfect solution, and we made up the other portion with salt and preservative. We put them into identical casks, the casks being specially made very tight and firm—oak casks, and small casks. We packed them in there, and we kept them without looking at them at all for five months. At the end of five months the butter made upon the dry principle was *that* depth rancid all round (*indicating*), and even in the centre was not pleasant; the one made on the dry principle with the salt had the salt showing out like a fur upon the butter when you bored it; the one that was made with a little pickle, not quite enough to keep the salt in proper and thorough solution in it, was decidedly better, but still was going tallowish—you could smell a tallowy smell upon it; the one that was made with a sufficient quantity of water, that is three times the weight of water to the salt, was nearly perfect, and the butter made with the preservative and salt was absolutely perfect—you could eat it perfectly well. We made another experiment afterwards with butter that came in, and was made by farmers on what is called the factory system—that is where a number of lumps are blended together. We blended up a certain quantity of stuff together, and we divided that, and we made it up in the same way, and we kept it for nine months. The stuff that was made with the preservative, at the end of nine months was quite eatable, while none of the other makes were so at all.

6364. Now, have you anything to tell us as to the use of colouring matter?—The South of Ireland Butter Merchants' Association, whom I represent here to-day, are very much divided upon that point. I believe they are to one man in thinking that we ought to be permitted to use preservatives, but they are very much divided upon the colour question. One set of them would say absolutely you should allow no colouring. The reason they say that is that they think if there was no colouring allowed in any food substances, margarine would not sell as it sells at present as butter. Therefore a certain proportion of the South of Ireland butter merchants are very strongly in favour of having the total prohibition of colouring matter in all food substances. Another large proportion of them—I should say they are pretty nearly equally divided—say that it is absolutely necessary to have colouring to suit the tastes of different districts. Now, in Liverpool you may send your butter as pale as *that* (*pointing to a sheet of paper*), and they have not the slightest objection to it, they like pale butter, and if you send them the slightest highly-coloured butter there is immediately a row—"your butter is too highly-coloured." Very often when the clover is strong you know it colours the butter very much, and very often we have the greatest difficulty to pick out butter that will at all suit Liverpool. Manchester likes it of a little bit better colour; Oldham likes it of a good deal better colour, and then when you come down here into the south they will not take pale butter from you at all. The greater part of the people here must have a nice strong straw colour, and down in some parts they must have it even of a very much higher colour than the straw colour. How are you to get that? You cannot possibly get it except by using colour, therefore those who have a scattered trade, trading north, south, east, and west, say that the colouring is absolutely necessary to meet your markets.

6365. Yes, but supposing colouring matters were prohibited in all butters—home, foreign and colonial—the market would have to be supplied whether the butter were of a beautiful colour or not?—Yes, I suppose so. You would have at one time of the year a high coloured butter, and you would have at another time of the year a very low coloured butter, and you would have great dissatisfaction.

6366. That change in the colour can be regulated a good deal by feeding the cows, can it not?—Well, I have tried as much work on feeding the cows as anybody, and I do not think it can.

6367. Not to make it uniform?—No.

6368. And not to make it effective?—It could be effected in this way—if we had all Jersey cows, but I know of no other way. I have tried feedings of all sorts for it, and the only way that I can keep up the colour is by having the Jersey cows. You see when clover is strong in the grass, and growing strong—clover hay does not do it—but when you have a clover growing strongly in the grass you always have a high coloured butter. In the limestone districts. where they have a great deal of clover, even in the winter we get a tolerably high-coloured butter, whereas on the red sandstone lands and the alluvial lands, where the red sandstone has been washed down off the hills, we never get that same high colour, not at any part of the year; and then you know that about a seventh of the trade of Ireland is creamery butter at present.

6369. That is creamery and factory butter?—No; about a seventh of it is creamery butter—that is butter made from centrifugally separated cream—that is the only butter that is entitled to the name of creamery butter. About one seventh, I think, at present of our whole make would be that. Then there is a very large proportion, every year increasing, of the factory butter. You get in a market, it may be 300 farmers coming in, and you will certainly have 50 different colours for those, just according to the herbage that the cattle are fed on. You will have 50 different colours at least. Then we have to try and blend those colours, and send them coloured to suit the different places. If, as I say, I want to go to Wales, or I want to go to Oldham, or to come down here with it, I have to have it of quite a different colour to what I have it for other places.

6370. On that question the Irish butter traders have not made up their minds?—They are thoroughly divided. All the people that are working the factory system are all strongly that it must be coloured, and the other people say, "We will do anything not to have margarine sold as butter."

6371. Is any margarine manufactured in Ireland?—Yes, both in Limerick and in Dublin they manufacture a great deal of it.

6372. Do the butter factories manufacture margarine?—I only know of, I think, two that do so publicly. I cannot tell you whether any of the others do so, or I will put it there are two that are registered as margarine manufacturers as well as being creameries. A very large maker in Limerick—the largest maker, a man who turns out often 20 tons a day of it—makes butter because he has to get an enormous quantity of milk, and at times he does not want all that milk, and so he makes butter, and sells that as butter, but, of course, he sells all his margarine as margarine. The butter trade of Ireland have no objection whatever to the margarine manufacture, you know. It is only the fraudulent sale of it as butter that we object to in any way.

6373. (*Dr. Tunnicliffe.*) I take it from what you have said that the butter in which you deal practically always contains preservatives?—The butter that I deal in, if I can, I always have it made with preservatives.

6374. Have you ever had any instances of complaint of your butter having gone wrong?—Of the preservative made butter going wrong?

6375. You said that your butter practically always contained preservatives?—Occasionally, of course, I have got butter without. No, I have never had complaints of it.

6376. You have never had a complaint of it?—Never. I have a letter here from a gentleman, telling me that he did not think I could have known it. He says, "You will be glad to hear of the wonderful keeping quality of your Mulgrave creameries. Mills had overlooked the last ten fifty-sixes he had got from you which remained in one store until this week"—which is the 27th of January—"and when he got them out he found they were equal to, if not better, than the finest sweet cream Danish that was coming in to him fresh every week, though they are now three to four months old. Did you imagine they could keep like this?" Now, that butter was shipped to that gentleman on the 28th August, and he brought it out in the week of the 27th of the following January. I have never had a complaint of any of my preservative-made butter not keeping, but I have had complaints of butter that I know was not made with preservative not keeping very long.

6377. That butter to which you refer contained 1 per cent. of preservative, is that not so?—No; it contained 1lb. of preservative to 112lbs. of butter.

6378. That is practically 1 per cent.—No; it will not ever work out to 1 per cent. We never show on analysis more than 0·8—that is the very outside that ever shows.

6379. You say there is no appliance for cold storage in so far as concerns the transit of Irish butter?—No. We have no cold storage in Ireland. There is only one cold store that I know of in Ireland, and that is in Cork, in the hands of a private firm.

6380. Has any attempt been made on the part of the people interested in Irish butter to get cold storage appliances?—I cannot answer you that. I know that a good many of the creameries have put up a sort of refrigerating plant, but I do not think they have been very successful. You know that the foreigners have a very large supply of cheap ice, whereas we have dear ice, and if you want to take it to any of our creameries, or if you want to take it to private dairies it would simply cost so much by the time it was there, and so much of it would be wasted that it would be prohibitory.

6381. (*Chairman.*) What ground can you have for saying that the foreigners have cheap ice, and you have dear ice?—Because he has a winter supply.

6382. Has the Normandy farmer cheap ice?—I cannot answer you about that, but I know that the Swede has for I saw him storing it, and plenty of it.

6383. You said the foreigner had plenty?—Yes, but when I speak of the foreigner I mean the Dane and the Swede.

6384. I think it is rather a loose statement?—Yes. The supply of Normandy butter at this time of the year is not a very great deal, it is not much more than the supply of our own Irish.

6385. (*Dr. Tunnicliffe.*) I take it that your view is that in the present state of dairy education in Ireland, and with the imperfect methods of transit that you have, preservatives are absolutely necessary?—Absolutely

Mr. R. Gibson.

7 Feb, 1900.

necessary for the sake of the consumer, quite as much as the maker.

6386. (*Dr. Bulstrode.*) You think there is a considerable difference in the way in which Danish butter is handled in this country by railway companies from that in which the Irish butter is?—I am sure of it.

6387. And you attribute that to the efforts of Mr. Faber?—I do. I attribute it to the interest foreign governments take in this trade of dairying.

6388. In other words, having an active representative in England to look after their interests?—Yes.

6389. Does it not seem a rational thing that you should follow the example set by the Danish Government, and have an energetic representative in England?—Undoubtedly our Government ought to do so.

6390. Then is the public to bear the brunt of that not being done, by having to accept butter with a larger amount of preservatives in than would otherwise be the case?—I do not follow you quite, because I think the public are not injured.

6391. That is hardly the point upon which you are giving evidence; the point is you make the statement that if the transit of butter in England were better controlled you would be able to do with less preservative, is that not so, as a fact—you stated, I think, that it was so?—I do not think I did. I stated that the difference between the way in which our butter was handled, and the way foreign butter was handled was very immense indeed.

6392. I think you answered Dr. Tunnicliffe just now in the sense that if proper methods of transit and storage and cleanliness were adopted the amount of preservative would not have to be so great as it is now?—If also that butter was used here as fast as the ordinary foreign butter is used, and if it was produced all through the year as the Danish and Swedish is.

6393. Have you any evidence to show that the Danish butter has not kept as well as the Irish butter?—I know perfectly well that when it comes here, because I have seen it scores of times, that if it is kept even for three weeks here it is deteriorated, whereas I know that Irish butter has often been kept here for not only weeks but for months, and it has not deteriorated, but is a perfectly good article to eat then.

6394. Is there any great necessity from the point of view of the public that the butter should be kept longer than three weeks?—Often it is absolutely necessary, for instance, as I say in 1898, when we produced 80,000 tons of butter, we produced 14,000, or 15,000 or 10,000 tons more than our usual supply. What was to be done with it?—Nobody would buy it; it was more than they wanted; it must be kept over until there was some demand for it. Anyway, a lot of our butter produced in the summer, if it would not keep, would have to be sold merely at a confectionery price, it would be thrown by. We have often to store butter. I know one firm in Cork, a very large firm of factory makers, and they have for two years in succession, at all events, shipped 500 tons at a time.

6395. To come back to my point, if your people were better educated you could do with less preservatives than you do at present?—No, not unless all the other "ifs" were in also.

6396. If the conditions with regard to the sale of Irish butter were the same as the conditions for Danish butter?—Then we could do without it altogether if our butter was sold in the course of a very short time, and if everybody knew that our butter would not keep, and that they had to use it at once, then we could do without the preservative. But on the contrary, we have always had the name of a keeping butter, and we have to have keeping butter. Our butter is not, as a matter of fact, used at the same rate. While you have one or two per cent. of the Danish butter coming over as saltless butter you have the saltless butter made from Ireland growing by leaps and bounds every year. We cannot get at the proportion, but I know that the proportion of this year is fully double in our district what it was in other years, what it was the year before, for instance.

6397. Then you do not yourself contemplate much advantage to the Irish industry by improved methods?—I do, undoubtedly. We want improved education very badly, and we want improved transit, but I say that neither of those—neither improved education nor improved transit would enable us to do without the use of preservatives unless our butter was here treated and handled as the foreigners' is, and unless we had got to have our butter produced all the year round.

6398. That is just my point, that if your butter were handled here by the railway companies——?—And by the retailers——

6399. As you say, the Danish butter is, then you could do with less preservative than you can do with now?—I do not accept that. I say that unless you add all the other "ifs" in it could not be.

6400. Then you do not accept that each detail of treatment increases the amount of preservative?—No, I do not say that there is any increase or decrease of the amount. I consider that there is a certain amount of preservative that will keep butter perfectly sound, and I consider that if you put less in it will not keep it sound; it may keep it sound for a week or ten days, but it will not make it a really keeping article. I have tried all sorts of proportions of preservatives. I have had experiments going on for two years at a time, and I have tried all sorts of proportions, and I find that to really keep the butter, to prevent its going wrong requires what I consider sums out to about 0·8, but other people say 0·5 will do it.

6401. What arrangements that you know of are made for cooling the milk on the farms in Ireland which supply the creameries?—There are absolutely no arrangements made in the farms except to stick the can into a tub of water. In the creameries they have arrangements for cooling. They have big cooling jacketed tanks.

6402. How long does it take for the milk to come from the farms to the creamery?—In some of them it will come six miles, and I have seen it coming, for instance, into the large creameries in Limerick from places where I know that it would have taken from, say 6 o'clock in the morning until 10 and 11 in the day time.

6403. So that it may be a long time in transit before it is cooled properly?—Yes.

6404. What regulations are there in force in the farms, do you know, for insisting upon cleanliness?—No regulations whatever. I think it is very badly wanted indeed. We have no proper inspection of our dairy farms, and what is worse no proper regulation even in a lot of the creameries. Of course, the proprietors themselves would do all in their power to keep the place clean, but there are absolutely no regulations in force; I wish there were. There is one matter that perhaps the Committee ought to know. Danish butter has been held up as being good for the producer, but the Danish farmer has never yet obtained the same price for his milk on an average that the Irish farmer does. They say that our butter makes less price, and all that sort of thing, but I think if the thing was thoroughly sifted out it would be seen that our butter fetches quite as much, and, in a good many cases, more.

Dr. A. Grünbaum.

Dr. ALBERT GRÜNBAUM, called; and Examined.

6405. (*Chairman.*) You are a Master of Arts, and Doctor of Medicine?—Yes.

6406. A member of the Royal College of Physicians, and lecturer on chemical physiology in the University College, Liverpool?—That is so.

6407. We understand that you have been recently on the Continent making inquiries into the various food Acts?—Yes; that is to say when on the Continent on a tour for the Sewage Commission we—Professor Boyce was there too—made inquiries at the same time about foods.

6408. What countries did you visit?—We were in France, Belgium, Germany and Austria, but we did not really inquire very much in France and Belgium; our inquiries were made in Germany and Austria principally.

6409. Did you direct your attention to the regulation of preservatives in food?—Yes.

6410. What did you find in Prussia, for example?—In Prussia the Food and Drugs Act is hardly more definite than here. There is a circular regarding milk which is issued by the Ministry of the Interior and two other ministries together, which gives directions to the various presidents of provinces, in which they say that the addition of preservatives should be totally prohibited.

6411. Is the Food and Drugs Act enforced in the spirit of that direction?—Yes. As a result of this circular bye-laws are made, and these are put into force by magistrates, but there is always the right of appeal to a court of law afterwards. The first circular of the German Government was issued in 1884, and I have here the last circular signed by the Ministry of the Interior, dated May, 1899. There you see amongst other things is the regulation that the addition of preservatives to milk —I am talking only about milk—should be totally prohibited. As regards wine there is a definite law which prohibits the addition of certain defined substances, such as salicylic acid, boric acid, and so on. That is actually law as regards wine and fluids like wine—I mean orange wine, and things of that kind would be included in it.

6412. There is a statutory prohibition for the use of preservatives in wine?—Yes.

6413. And municipal bye-laws regulating their application to food?—Yes.

6414. To milk, for instance?—Yes.

6415. To milk only?—I am not certain. That particular circular applies to milk only, the reason mentioned in the circular being that it was found impossible to give definite directions, or make definite standards for milk for the whole of the kingdom.

6416. Did you ascertain whether there had been any convictions before the magistrates at the courts of law? —Yes. In the case of Hamburg, for instance, every case in which they found boric acid or any preservative was prosecuted, and in the majority of cases convicted.

6417. In milk?—Yes. That is the case in other places too.

6418. With any other foods?—Yes. One of the favourite preservatives used in Germany is apparently sodium sulphite for addition to minced meat. There are numerous convictions in such cases, very often with imprisonment even up to six weeks.

6419. Are you acquainted with the law of this country? —Yes, I think so.

6420. Would the presence of sodium sulphites in meat in this country contravene the law?—I do not know that I am competent to give an answer on a purely legal question like that. It certainly is injurious to health above a certain amount—and a comparatively small amount that is too.

6421. Then you went on to Vienna, I think?—Yes.

6422. What did you find prevailing there?—In Vienna there is a similar state of affairs, that is to say the law on it does not actually say that you shall not add boric acid or formalin, or anything of that kind, but the bye-laws do. Lately the City of Vienna obtained an expert opinion on the subject as regards the trade in milk, and amongst other things this opinion says that preservatives added to milk should be without exception forbidden—and that is to include also the addition of sodium carbonate.

6423. Then the general drift of public opinion throughout Germany and Austria is against the use of those preservatives?—Yes. For instance, they are now working at a law in Prussia in which the addition of preservatives to meat, like borax and boracic acid, will in all probability be prohibited. In Switzerland there is a direct prohibition against the importation of meat which has borax or boric acid added to it as a preservative.

6424. Does that mean that bacon cured with salt, and possibly saltpetre, and afterwards packed in borax would not be admitted?—Not if they find by taking a piece of the meat that they could prove the presence of borax in it, and, of course, borax does tend to penetrate.

6425. The object then is to protect the consumer against taking boracic compounds with his food?—Yes.

6426. (*Dr. Bulstrode.*) There are, I think, in Austria certain ministerial decrees which prohibit the use of specific preservatives and colouring matters?—Yes.

6427. Could you tell the Committee to what preservatives and colouring matters those decrees relate?—No, I am afraid I do not know about it in Austria.

6428. Do you know that salicylic acid is prohibited in Austria?—All preservatives, for instance, are prohibited in the case of milk. As a matter of fact, when we were in the Imperial laboratory there, that is to say where the foods are examined, they told us that it was very rare to find any preservatives added to milk in Vienna. As regards Hungary, in Buda-Pesth they are constructing a law which is to be so wide that they can include any preservative that they choose if they happen to forget to definitely mention it.

6429. There is a Committee sitting on the subject, in Austria, I think, is there not?—I do not know about that.

6430. Some analytical chemists have formed a sort of Committee, and are drawing up a code in which they are separating the preservatives which are to be prohibited from those which are to be allowed?—I was not aware of that.

6431. Which country are you most familiar with—Germany or Austria?—Germany.

6432. Preservatives in milk are prohibited altogether in Germany, are they not?—Yes.

6433. Could you tell the Committee the evidence upon which that determination has been arrived at?—No.

6434. Take boric acid in the first place, why was boric acid prohibited?—I think it was merely on the general idea that preservatives as a whole would prove injurious.

6435. (*Chairman.*) Or might prove injurious?—Or might prove injurious. In 1884 when the milk circular was sent out they mentioned as a matter of fact that the addition of preservatives would particularly be likely to injure children—that was assigned as a reason in the ministerial circular.

6436. (*Dr. Bulstrode.*) But no experiments were made as the basis of this legislation were they?—Yes, at any rate there was what they call a "Denkschrift" issued by the Imperial Board of Health, the Reichsgesundheitsamt. That I have not seen, but apparently it gives reasons.

6437. Experimental reasons or experimental evidence? —I should say so, but of that I am not certain.

6438. Or presumptive evidence?—That I do not know. I have not seen the thing actually.

6439. With regard to formalin, is formalin used at all in Germany, or has the question not arisen?—Yes, it has, and they have only occasionally found it; in Hamburg, for instance, they have only found it once, although it has been looked for.

6440. And salicylic acid?—And salicylic acid. I believe they have found two or three times, but not within the last year. I have a paper which says that last year formaldehyde and salicylic acid were not found in any case.

6441. (*Dr. Tunnicliffe.*) That refers to milk?—Yes. My attention was chiefly directed towards milk and meat, and, of course, in Germany, wines.

6442. (*Dr. Bulstrode.*) But you are not in a position to inform the Committee whether the legislation and the prohibition in Germany are based upon what we may call the evidence of expectation—to coin a phrase—or upon experimental evidence?—No. In the case of the sodium sulphite various experts who have given evidence in Germany describe the symptoms that follow the administration of sodium sulphite.

6443. Can you tell us the doses or the amounts of sodium sulphite which have been discovered?—Yes; they vary very considerably, from, for instance, in one case here mentioned, 0.86 per cent., while in another case——

6444. (*Dr. Tunnicliffe.*) Was that in milk, too?—No. I do not think it has been found in milk. This is in meat, and more particularly in the minced meat, which, as it is used in Germany largely for the food of invalids, they are especially keen on guarding against contamination. Sodium sulphite makes old mince meat look as if it were quite fresh stuff, and it varies from between 0·86 down to 0·09 per cent—that is, nearly 1 per cent.

6445. (*Dr. Bulstrode.*) Is there any evidence pointing to the fact that actual injury has been done by the addition of the larger amounts in any case?—No; I do not think they have found out that anybody has been made ill from it; but Professor Pfeiffer, of Rostock, found that 0·125 grm. given experimentally to healthy persons produced deleterious effects.

6446. In regard to the medical evidence which was given; what was the general trend of it?—It was that the addition of this material caused headache, diarrhœa, indigestion, and catarrh.

6447. Even in quite small doses?—Yes. In one case which came before the law courts I think it contained only ·08 per cent., and there they decided that that quantity was so small that it could not do any harm, and the

Dr. A. Grünbaum.

7 Feb. 1900.

man was therefore acquitted. In other cases, as I have said, there were either fines, imprisonment up to six weeks for it.

6448. In regard to colouring matters, have you also gone into that question?—No, only as regards copper sulphate in the peas. There it was decided that the amount required in order to colour the peas was so small that they did not think it would have any injurious effect.

6449. You are speaking of Germany?—Yes.

6450. Is any standard laid down?—That I do not know.

6451. But, at any rate, the use of copper in peas in Germany is not prohibited?—Not in minute quantities.

6452. Do you know anything about it in Austria?—No.

6453. Do you know that it is, as I think I am right in saying, at the present time prohibited, but that it is possible it will be shortly allowed again?—No, I did not know that.

6454. In Austria, I think, there are certain colouring matters which are prohibited, and others which are allowed. Can you give the Committee any information as regards the grounds upon which this division has been made?—No, I did not make any inquiry into colouring matters; I only inquired into milk and meat.

6455. Are you familiar with the practice in other countries besides Austria and Germany?—No.

6456. Can you tell the Committee anything with regard to Switzerland?—No; I can only refer to this particular law about the importation of meat containing borax.

6457. Did you find in the course of your inquiries in Germany that there was any strong feeling in the medical profession or among the people with whom you talked?—Yes; the medical profession seemed to feel pretty strongly that the addition of preservatives was undesirable.

6458. Undesirable?—Yes.

6459. On what grounds?—Firstly, because they could not know when their patients were taking it, and secondly on general principles. As far as they could see, there was not really any difficulty, as a rule, in getting milk which had not preservatives in it to supply even big towns like Berlin, consequently they did not see why it should be added.

6460. Will you tell us the population of Berlin?—I am not quite certain about it, but I fancy it is about one and a-half million.

6461. The population of Berlin is supplied with milk without preservatives, is it not?—Yes.

6462. Do you know that as a fact?—Yes.

6463. And Vienna also?—I am not absolutely certain about Vienna, but in the municipal return for the year they do not mention that they have found preservatives in the number of milk samples which have been examined, except in one case in which they found sodium carbonate in large quantity.

6464. Do you know if this is a fact in Austria: "Salicylic acid is forbidden in milk, and also other preservatives, such as borax, boracic acid, and soda, the reason presumably being the large amount of milk consumed by invalids and children"—do you know if that is the fact?—Yes, that is what we were given to understand.

6465. (*Dr. Tunnicliffe.*) I should like to ask you if you could tell the Committee how they could get hold of the Denkschrift to which you refer. I take it that the Denkschrift is a resumé of the medical evidence upon the subject?—Yes, you can get the address I think from this journal.

6466. I take it that the bulk of your remarks apply to the milk trade?—Yes, and to the minced meat trade particularly.

6467. Do you know anything about the presence or absence of preservatives in beer?—In Germany that is forbidden, too. There is a law on that subject, I believe.

6468. Is it forbidden in Austria?—Yes.

6469. Is sodium sulphite included in those preservatives which are forbidden in beer?—I do not know whether sodium sulphite is specially mentioned. You see all these cases of sodium sulphite in meat apparently have arisen through a substance which is called "meat preserve crystal," which has had a large sale in Germany, and sodium sulphite, which these butchers—or some butchers at any rate—have been in the habit of adding.

6470. (*Chairman.*) Did you have any opportunity of inspecting the milk depôts in Berlin or Vienna?—No, I did not do that.

6471. Are you acquainted with the mode of distribution; can you tell us whether it is in open or closed vessels?—In Berlin it is in closed vessels; there is a big cart with a closed vessel and a tap.

6472. I mean in the sense of being a hermetically sealed vessel; with the tap, of course, it would not be hermetically sealed?—No, there is a tap on the outside.

6473. You do not know whether the system of distributing bottled milk prevails in either of those cities?—No. You can get sterilised milk, but they do not allow boiled milk to be called sterilised milk; it has to be done according to some accepted mode.

6474. "Bottled milk," I said; bottled milk is not necessarily sterilised. In some places the supply is nearly entirely in bottles, but perhaps that you do not know?—I think it is in the smaller towns.

6475. (*Dr. Bulstrode.*) In Austria did you ascertain anything with regard to the use of saccharin?—No. There was recently published—I do not know whether you saw it—from the German Reichsgesundheitsamt, a "Gutachten" as regards saccharin.

6476. (*Chairman.*) Have you any general observations you would like to make on the subject?—I should like to say that it seems to me that on general grounds preservatives should be forbidden, because, so far as we know, what is injurious to bacteria is also injurious to the cells of higher developed organisms, and although in the latter case they are capable of being replaced, which the bacteria would not be, nevertheless it does not seem to me that the highly developed organism should be called upon to replace cells which have been destroyed by disinfectants.

6477. Does your objection to the use of preservatives extend to other substances besides milk?—Yes, it certainly would, for instance, in the case of sodium sulphite, and it seems to me it should do also in the case of boric acid; borax I am not so certain about. You see, the addition of preservatives, as has been pointed out, I believe, before this Committee, only harms the putrefactive organisms, whilst it does not really usually attack the more potent pathogenic organisms, so that they still remain effective, while you have simply destroyed the putrefactive organisms. I think altogether we ought to aim really the same way as in surgery, where instead of antiseptic you aim at aseptic surgery. So in the same way we ought to aim at aseptic rather than antiseptic food. So far as one can find out, apparently the difficulty is merely one of expense. In Germany the milk is transferred in railway vans, which are cooled by ice, and there does not seem any very good reason why that should not be the case here. In fact, ice is apparently used in England to a much less extent than it might be. As to the interference with trade, judging from other things in Germany on what was more particularly relevant to our inquiry, for instance, the question where manufacturers had to dispose of their own waste we found that although they were put to considerable expense in doing that, nevertheless, so far as we could ascertain, it did not hurt the trade. They were enterprising enough to keep on at their trade in spite of these extra expenses. I suppose that if the German manufacturer and merchant can do that we ought to be able to do it here.

6478. Do you look upon it as established that putrefactive micro-organisms are generally of a lower vitality than pathogenic organisms?—Some of them certainly are. I was thinking more particularly of a spore-bearing pathogenic organism, which most of the putrefactive ones are not. The great objection, however, seems to me that we have not got any antiseptic that we know which is injurious and will touch bacteria which will not also injure living cells.

6479. And in some instances affect the digestibility of the food by hardening it. Is that not so?—Yes. It does not apparently—not, at any rate, in the doses used—affect the ferments themselves; in fact, in doing experiments on digestion one sometimes adds an antiseptic in order to prevent putrefaction; but that is quite a different thing to affecting the cells which produce the ferments.

6480. In the event of the use of some or all preservatives being sanctioned, would you think any advantage would be gained by a notification of the presence of these preservatives accompanying the article?—I should say so, certainly. One always prefers to know what one is having, and a doctor who may be prescribing the same

Dr. A. Grünbaum.

7 Feb. 1900.

sort of thing would like to know what dose his patient is taking.

6481. (*Dr. Bulstrode.*) You are a physiologist, I take it?—Yes.

6482. Might I ask you what value you as a physiologist think on general principles is to be attached to experiments made upon the lower animals in regard to conclusions as to the effect of preservatives?—It is necessary, of course, to get comparable results, and for that purpose one must have animals in the same stage; and animals, I think they ought to be, whose digestions are somewhat similar. I do not think there can be much good, for instance, in making experiments on herbivorous animals and then trying to compare the results which you obtain on man. Again it is not any good making experiments on full-grown animals if you wish to draw deductions as to the effects on infants. But as a whole I think one can draw a fair inference. I should prefer, for instance, to make experiments on monkeys rather than on cats or dogs, but nevertheless I think from experiments on cats and dogs, provided they are in a similar stage of growth, you can draw a fair inference as to what the result is likely to be on man; only I do think that animals seem to stand what one might call unnatural food, or at any rate unnatural additions to food as a whole, weight for weight and age for age, better than human beings.

6483. Would you make that remark with regard to monkeys as well; would you put monkeys in that group?—No, because I have not any pharmacological experience of monkeys; I have not experimented on them with drugs.

6484. (*Chairman.*) Would you say that the idiosyncrasies of man are nearer to those of a pig than to those of a cat?—That I really do not know about. I know it is alleged that the pig in structure resembles man more nearly than some other animals, but I have no definite knowledge about that.

6485. He is more like a man in his general food, is he not?—I hope not.

6486. He is omnivorous?—Do you mean in regard to his digestion?

6487. What I mean is that a man is less purely carnivorous than a cat, and is omnivorous like a swine?—Yes, but still I think the pig takes a good many more bacteria into his inside.

6488. (*Dr. Tunnicliffe.*) I take it from what you have said just now in reply to Dr. Bulstrode that you would think that one would be justified in deducing a positive result from animals to man, but not a negative one?—That is so.

6489. That expresses your opinion, I think, more clearly than it was expressed before—you understand what I mean; if you get a positive result you would be practically certain you would have a positive result in man, but if you get a negative result it would not follow?—With regard to preservatives?

6490. With regard to preservatives?—Yes.

TWENTY-SECOND DAY.

Friday, 9th February, 1900

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

H. TIMBRELL BULSTRODE, Esq., M.D.

F. W. TUNNICLIFFE, Esq., M.D.

CHARLES J. HUDDART, Esq., *Secretary.*

Professor JOHN ATTFIELD, called; and Examined.

Prof. J. Attfield.

9 Feb. 1900.

6491. (*Chairman.*) You are a Doctor of Philosophy and a Fellow of the Royal Society, are you not?—Yes.

6492. You have been for thirty-four years Professor of Practical Chemistry to the Pharmaceutical Society of Great Britain?—Yes, from 1862 to 1896.

6493. You are the author of a manual on general medical and pharmaceutical chemistry?—That is so, seventeen editions, I may say.

6494. And also editor of the "British Pharmacopœia"?—Yes.

6495. I understand that you are prepared to lay before the Committee the results of certain observations made by you as to the action on the human subject of some of the modern preservatives used in food?—Yes, I am.

6496. Will you kindly tell us what you can?—The experience that I have to lay before the Committee relates, of course, partly to my professional knowledge as a scientific chemist. But I suppose that my chief qualification for appearing before the Committee is that personally I have been for many years what is termed a dyspeptic—I have been very dyspeptic—and have brought all the knowledge I have of chemistry to bear upon the matter with a view to my relief—as would be natural enough. Considering that the digestive processes are nearly all chemical processes, I thought that I could, perhaps, save myself much trouble and discomfort and pain; and I have succeeded. Still, I have acted under due medical and surgical direction. I perhaps ought to have mentioned that first, in order that it may be seen that I have not been simply adopting some amateur experiments. I have acted under the direction of the late Sir William Savory, the eminent surgeon, who was a very old friend of mine; he and I were demonstrators at St. Bartholomew's Hospital together, and he has kindly been my friend in this personal matter as well as in many other directions. He it was who at first advised me to use antiseptics to prevent that unnatural decomposition of food in the stomach which gives rise to gas, and therefore to distention, and therefore to discomfort and even pain. He recommended me to use various antiseptics. Then, too, the late Dr. Habershon, who was a great authority on dyspepsia, also recommended me to use antiseptics, and Doctor, now Sir Thomas, Lauder Brunton, and also Sir Richard Quain, with whom I was associated in connection with the "British Pharmacopœia," he being the President of the Medical Council. So that I have acted under proper advice. The antiseptics that I have used under this advice have been carbolic acid and sulphurous acid taken in the form of sodium thiosulphate, commonly called sodium hyposulphite, creosote, and boric acid. I do not know whether it would be interesting to the Committee, having regard to their Terms of Reference, to give the doses?

6497. In the case of boric acid it would be so?—Then the quantity of boric acid has been from 10 to 15 grains three times daily. By way of experiment I have taken very much larger quantities; but that has been found to be sufficient to prevent this unnatural, abnormal decomposition of food in the stomach to which I have alluded, and which appears to me to be due simply to ordinary natural causes—that is to say, to food kept at high temperature in a moist place, and there for a much longer time in the case of an invalid, a dyspeptic—than it would be in the case of a healthy person. I have got abundance of experimental evidence to show that food has commonly remained in my own

Prof. J. Attfield.

9 Feb. 1900.

stomach not for the ordinary period which commonly separates meals, four hours or so, but for eight hours and much longer. In the case of some uncooked fibrous foods, which can easily be traced by the eye when you see the contents of the stomach—such, for instance, as the skins of black grapes—they will remain for a week or ten days, in small quantities, of course, a few just hidden up, I suppose in the coats of the stomach, or still more likely, getting to the bottom of the stomach. I can give experimental evidence of that too. Those things are not digested in the ordinary period of four or five hours that separates meals, but take a much longer time. It is such fibrous articles, chiefly vegetable fibres, such as the fibres of cabbages, sprouts, celery, and so on, that remain in the stomach, according to my observations of the washings out of the stomach, that take so long to digest, and that are liable to ferment, and it is this fermentation, resulting in gas, which boric acid prevents in the doses that I have mentioned.

6498. The aggregate daily dose being between 30 and 45 grains?—That would be so. I have taken double that for that matter, but that would be the common quantity. I have generally found 10 grains sufficient to prevent the decomposition.

6499. (*Dr. Tunnicliffe.*) Three times a day?—Yes; I have taken as much as 60 or 70 grains in the day, but only for experimental purposes.

6500. (*Chairman.*) Have you ever found any inconvenience arise?—No. I have taken the larger quantities latterly, since the question of food preservatives has come up. I was rather anxious to know how much one could stand, and what the effect would be. I have taken a large quantity like that, and I never could detect any influence harmful. A far smaller quantity, namely, 10 grains, has always seemed to me to be sufficient to prevent the fermentative decomposition that I have spoken of; but I have taken 30 or 40 grains at a time, and those quantities did just as much work, I need not say, as the 10 grains, but nothing more. I never could detect any inconvenience whatever of any kind.

6501. Boric acid is voided through the kidneys, is it not?—Yes, I believe it is.

6502. You can assign no limit to the amount which can be got rid of in the day?—No, I have never made any other special experiments than those I have mentioned to the Committee. My plan of taking that particular antiseptic, boric acid, has been now for some years by, so to speak, peppering it on to green vegetable food from a castor. I have generally had a little castor (like this) by the side of my plate. Inasmuch as I rarely needed to take antiseptics for meat or anything of that kind, it has seemed most simple to just pepper it on, to green vegetable food especially. I perhaps ought to say that I have never found any discomfort from starchy food such as bread or potatoes—not the slightest; but fibrous food, or what the chemist would call cellulosic food—that is to say, the cellulose rather than the starch of vegetable food, is what the stomach, in my case, seemed to have a great difficulty in dealing with and breaking down. I may say that my proof of that is that, having, by the advice of these surgeons and physicians, and of my family medical adviser, Dr. Haycraft Berry, some ten years ago, adopted another plan altogether, namely, at the end of four or five hours, when it may be assumed food ought to have digested, and that any food then remaining is liable to decompose—then swallowing an ordinary stomach tube, pouring warm water down the tube, and then turning the outer flexible portion down the other way, and so converting it into a siphon, and running off the residual contents of the stomach. Doing that two or three times over, perhaps, one in that way removes all the residual food which, presumably, is not going to do one any good, however one may persevere, but rather harm. Washing out that residual food, then I should have the chance, you see, of examining that food, and, being a chemist and a microscopist, and accustomed all my professional life to observe accurately, I could see what length of time was necessary for various kinds of food to digest—which would digest in reasonable time, and which would not.

6503. Some kinds of food you found little or no difficulty in dealing with?—Yes, that is so.

6504. Do you find their digestibility affected by the boric acid?—No, not in the slightest—no matter what quantity of boric acid I might take or might not take. I have always found that starchy food digests within four or five hours if it is only in a proper condition. But if it is uncooked starch, and especially if it is in a clammy condition, as new bread, for instance, which is proverbially indigestible, then there is a different result. What I mean is, that the mechanical condition of the starch has, it seems to me, a very great deal to do with it. Rice grains not very thoroughly cooked, to a pulp, for instance, are liable to remain undigested after a reasonable time; certainly new bread, imperfectly cooked bread, will remain in that way; so will anything which is not only fibrous, not only hard, but is in a close, clammy condition.

6505. Such as the man in the street would recognise as indigestible?—Yes, precisely; these things do not digest, however soft they may be, the work of digestion does not go on. Lumps of sweetbread are troublesome, not but what they are soft, as everybody knows, and very nice if properly cooked, but, nevertheless, there is a difficulty in getting rid of clammy lumps. I have peppered sweetbread with boric acid so as to keep it from fermenting, and in this way I have been able no doubt to digest it when I could not if I did not take boric acid.

6506. You mean that the boric acid enables you to retain it long enough in the stomach without septic fermentation proceeding, and therefore your digestion is enabled to deal with it?—Slowly to deal with it, that is so.

6507. (*Dr. Bulstrode.*) Your evidence would tend to show that in your case the amount of boric acid which you have been accustomed to take does produce an inhibiting action upon certain putrefactive bacteria—would that not be so?—Yes, I suppose so. I am not an actual bacteriologist, although I have to do something in that way, but I should certainly come to that conclusion.

6508. Therefore, that amount of boric acid which you took may be held to have a very considerable influence upon vegetable cells?—That I do not know. I do not see where the inference comes in there. Whether I take boric acid or no, unfortunately these fibrous vegetable structures or fibres remain there, and do not digest—they do not get worked up to a pulp.

6509. The inference is that the operations of certain bacteria are inhibited, is it not?—Yes, that appears to be so, certain kinds of bacteria.

6510. Are we to take it that formerly you used to wash out your stomach?—I have washed out my stomach for ten years.

6511. You do not do it now?—Not so much for dyspepsia, for of serious dyspepsia I am now cured, but once now and then if I have by accident taken some undesirable food, or perhaps taken a little too much—I mean too much for any weak gastric organ, then such a sense of irritation comes about that one washes out.

6512. I do not quite understand the relation between this washing out and the boric acid?—Whether I have taken boric acid or not, the washings show on examination that boric acid has no influence apparently upon them so far as digestion is concerned. It does prevent the abnormal changes which result in gas and uncomfortable distension of the gastric walls and pain, it does not prevent the natural changes which result in satisfactory digestion.

6513. Of course, you only add the boric acid at the moment when you are about to take the food?—I have commonly done that. Years ago—I forget now who advised me—I used to take 10 grains two hours after a meal. I did it, of course, being loyal to my adviser, but after a bit, when I got a little more knowledge about the matter, and could see which kinds of food were indigestible and which not, then, as a chemist, it struck me that the best thing to do would be to put boric acid on the indigestible kinds of food on one's plate. That is how I adopted that plan.

6514. I mean probably there would not be an opportunity for any effect to be produced upon the food by the action of the boric acids which you use?—No, not before eating.

6515. So that really what your evidence would come to is that in the specific condition of dyspepsia from which you suffered you found boric acid taken with certain forms of food prevented this dyspepsia or minimised it?—That is so. Then there is the further inference to which I alluded just now. The further inference I make is that inasmuch as I get a similar appearance of the particles of food as washed out of the stomach whether I have taken boric acid or not; therefore, the boric acid does not apparently at all prevent those articles of food from being digested.

6516. I think you say in your synopsis that you have made some bacteriological investigations with regard to the washings out?—No, I said I was not a bacteriologist, but, in fact, my son is.

Prof. J. Attfield.

9 Feb. 1900.

6517. Has your son helped you in this?—Yes.

6518. It would be very interesting to know bacteriologically to what the observations upon cultivations from the washings out have led?—That I can tell you—more or less second hand, of course. My son made a number of experiments on the washings running over some months, and he seemed finally to come to this conclusion that there was nothing much to be learnt by the bacteriological examination. What was perfectly obvious was that there was an abundance of *sarcinæ ventriculi* produced; there were myriads of those curious little bale-shaped particles.

6519. Did he make no cultivations on nutrient *media* from the washed out substance?—Not many, because he did not feel inclined to carry on the examination. As regards the *sarcinæ*, he said there was nothing much further to learn about them, and as regards other things he tried a few experiments on cultivations, and could make nothing of them having personal or public interest.

6520. In your synopsis you say, "I am aware that salted and smoked food is said to digest relatively slowly, and it does, but not more slowly, I find, than all tissue-hardened food; the retardation is not due to the antiseptics"?—Yes, I have come to that conclusion.

6521. But some of those antiseptics are distinctly hardening agents—formalin, for instance?—That is so. I do not know anything by personal experience dietetically about formalin, as I never took any formalin.

6522. I mean that any conceivable food which has been kept by formalin might be in such a hardened condition that it in itself might have produced retardation of digestion, might it not?—I think that is quite possible. I know a great deal about formalin and its action upon albuminoid substances.

6523. You do?—Yes, I do, but not dietetically, as I have never taken anything preserved by formalin.

6524. (*Chairman.*) Not consciously?—Not consciously.

6525. (*Dr. Bulstrode.*) Could you tell us what you know of the action of formalin?—I have had to examine its action on plates of gelatin which have hardened to such an extent that they can be used for wall covering, for instance.

6526. In what strength was the formalin which you are now speaking of?—I do not remember the strength, but it would be very strong, of course—quite beyond the range of any food or anything of that kind.

6527. Could you not give an approximate idea? Where did you get the formalin from?—I could tell you by reference to my memoranda—I think I could give actual figures and so on. This was a matter in which I was consulted by some folks who wanted to support an inventor in producing formalin-hardened gelatin for general use for many purposes. They got as far as this, that very thin plates—extremely thin plates—thus hardened could be used for making coloured bags for sweetmeats. You see, such plates would look very pretty, and confectioners found that there would be a great demand for the sweets that they put into such little bags as that; and, in fact, I believe the article is sold very largely to this day. There was a hope that something could be produced that would almost supersede leather by pushing the action, but when I was engaged in the matter I found that could not very well be done.

6528. How long was this ago that you are speaking of now?—I should think about three years perhaps.

6529. Three years ago?—Two to three years ago.

6530. Where did you procure the formalin which you experimented with?—I got some from wholesale druggists for the experiments I made myself. It was a wholesale firm in the City.

6531. Do you know what the composition of the formalin was?—It was, I think, the ordinary aqueous 40 per cent. article; that is 40 per cent. of formic aldehyde.

6532. You had a great deal to do with the "British Pharmacopœia," I think?—Yes, I have been the editor; I am the editor of the present "Pharmacopœia" for the Medical Council.

6533. Is it the fact that in the last edition the dose of boric acid was diminished from 10 to 30 grains to from 5 to 15 grains?—Yes, it was diminished as compared with the dose mentioned in the previous "Pharmacopœia" of 1885, that is from "5 to 30 grains" to "5 to 15 grains."

6534. Could you tell the Committee why that was done?—Simply because it was found by the experience of all the members of the Pharmacopœia Committee (and my own personal experience) that in the case of that particular drug 5 to 15 grains would do everything that 10 to 30 grains would do. That was the only reason.

6535. Are we right in inferring that 10 to 30 grains would do more than from 5 to 15?—That is not so.

6536. Would do no more?—Medicinally they would do no more. Having in view the quantity of material in the stomach, for instance—I am speaking now of matters that I know about myself—5 to 15 grains there would be ample, and to put in 10 to 30 would be useless. I tried it up to 60, and I could not get any better effect, if I may say so, from the point of view of discomfort, with 30 to 60 grains than I could with 5 to 15.

6537. You took 30 to 60 three times a day, did you?—No, I did not. On one occasion I took 50 grains twice in the day.

6538. You did not keep that up at all?—No, I did not. I have kept up above 30 grains, that is to say, 15 grains three times a day week after week, which is a total of 45 grains daily.

6539. (*Dr. Tunnicliffe.*) I think you said that you had taken some preservative which would at any rate be practically the same thing as sodium hyposulphite?—Yes, the sodium hyposulphite would yield sulphurous acid.

6540. That would act in the same manner as sodium hyposulphite in beer then from the chemico-biological standpoint?—No doubt it would. Yielding, as it does, sulphurous acid, it was a very convenient way of taking sulphurous acid. That was by Dr. Habershon's suggestion. I produce his prescription.

6541. Therefore your experiences that you were telling the Committee of in this regard would have relation to the use of sodium hyposulphite as a food preservative or as beer preservative?—Yes, I think so. That was Dr. Habershon's favourite prescription he told me.

6542. Would you tell the Committee shortly what your experiences were with the equivalent of sodium hyposulphite?—I found it quite prevented——

6543. The dose please first that you took?—The dose was that you see mentioned in Dr. Habershon's prescription, namely, 15 grains from once to three times a day. I found that in those quantities it quite prevented the decomposition to which I have referred, that is the production of gas, distention, discomfort, and pain. But when there were eructations there was an unpleasant flavour, and odour, of sulphurous acid, which does not attach to boric acid. I think that would be my personal chief objection to sodium hyposulphite.

6544. More especially I should like to ask you with regard to whether you noticed that it also had practically no effect upon the digestive processes in so far as you were concerned?—I cannot fully answer that question, because when I took sodium hyposulphite it would be five or six years before I adopted the use of the ordinary washing tube to which I have referred.

6545. So, therefore, your experiences on this head are not so valuable as the former ones?—No, they are not. I have tried it once or twice since, as a matter of experiment. I have taken two or three doses of the hyposulphite, and then examined the washings. I could not find any difference, but then that was only a two or three days' experience, whereas my experience of boric acid runs over some years, and to hundreds of experiments.

6546. We have had it in evidence repeatedly before this Committee that it is improbable that if a substance exerts an inhibitory action upon the bacteria causing decomposition, it will not exert the same, or, at any rate, a very similar action, upon the digestive enzymes; do you agree with that statement?—That seems to me to be a most reasonable inference, but it does not accord with my experience, it is not true in my judgment.

6547. (*Chairman.*) I would like to ask you whether you are prepared to give any general opinion as to the necessity for regulating the use of these preservatives in food?—I naturally have had opinions on the matter, for I have been consulted in many of these cases that have been brought before the courts, but I do not think my opinion is of any particular value on matters of that kind. I only have the experience of a chemist and an analyst and of a consultant who is appealed to by parties in actions.

6548. As a citizen, as a consumer who has devoted some attention to the subject, and who is acquainted with the nature of the substances used, do you think that their presence ought to be notified, and that the consumer ought to be aware of what he is taking?—In the abstract I should say yes to that. I think he should, so far as that can be done. I see no objection to the principle, but I do not quite see how it is to be carried out. I should rather support the indication on labels of things that are contained in metal or other cases—as to what such-and-such a thing has been preserved by. Of course, the Committee will see that from my experience I have no more objection to boric acid, for instance, than to salt, but I think it is quite reasonable that if an article has been prepared with salt, that might be stated on the label, and if prepared with boric acid that might be stated on the label. I should see no difficulty, so far as labelling is concerned. It is only when you come to selling things retail that I see a difficulty. Take, for example, a ham and beef shop; a quarter of a pound of beef and two ounces of ham, so I am told, is a very common order; I do not know whether you are to wrap that in paper with a label on it or something; I do not see how it is to be done effectively.

6549. Salt is itself a food, is it not?—Well, I do not know. I have often thought about that matter. I do not see why it is any more a food than boric acid would be. It is true it is an article that everybody is accustomed to, but I have often speculated as to why one should take salt. A friend of mine, a consulting engineer, never takes any.

6550. It is one of the components of the human body?—Yes, I know, and, of course, there would be something in that. On the other hand, boric acid is found, though of course to a minute extent, in many vegetables; it has been found in wines and in the hop plant, and therefore in beer, but in minute amounts. I do not mean to say that there is any quantitative parallel to be drawn between that and salt.

6551. Is not the great difference between such a preservative as salt and such a preservative as boric acid that salt announces its own presence?—Yes, because apparently you have to use a large quantity of salt as compared with the quantity of boric acid; and then comes in the natural flavour of the salt—you can detect it by its flavour and you cannot detect boric acid by its flavour because it has no flavour.

6552. I will put this further question to you: You, as an adult, find no inconvenience from the use of boric acid in considerable quantities and regularly; is it not conceivable that an infant fed entirely on milk preserved with boric acid might suffer some serious consequences?—In answer to the question is it conceivable? I say yes directly; but there I can give no experience to the Committee, of course, except hearsay experience. I think that there was a gentleman from Glasgow before the Committee, Dr. Bell, whom I once met in a case in Wales, in connection with this question; he assured me—and I may refer to it, although again it is secondhand, because I am sure he must have mentioned it to the Committee, if he has been before the Committee—that his own children, when quite children, had milk given to them day after day in large quantities with boric acid in it. That is really the only answer I can make.

6553. "When quite children" is rather vague, is it not?—Yes.

6554. I spoke of infants?—I had the impression from him that he began with them as infants to give them milk with boric acid. He had a great idea of the value of milk, and his notion was to keep the milk so that he could give it to them in the summer, for instance, at any time in the day. They had big lots of milk, and, as a matter of course, he spoke of their fine appearance, their growth, and their general thriving condition.

6555. It is not every infant who would stand treating with salted milk, is it?—I do not know much about these matters, but I take it that it is a question of quantity.

6556. And that would be the case with boric acid also?—I should think so.

6557. It is desirable to know what quantity of this drug is being consumed in the food?—Yes, I should think so; I should think that is only fair and right—I should like to know it myself.

6558. But you do not attach great importance to it?—No, not great importance. There, I think, *caveat emptor* begins to apply. Persons taking food, as they do several times a day, every day of their lives, ought reasonably to be expected to have some knowledge even gained by their daily experience; and, secondly, I take it that manufacturers who use these things would rather want to preserve the lives and health of their customers than to damage them—there again would come in some sort of a guarantee. But really these are only my own speculations, and I do not pretend to be an authority.

6559. Is it not rather straining the adage to apply *caveat emptor* to an infant?—Yes, and I did not mean to do that for a moment. I was only alluding to adults and persons who had to buy—which infants have not.

6560. (*Dr. Bulstrode.*) May we take it that you, having a great deal to do with the British Pharmacopœia, and having regard to the fact that the pharmacopœal dose for an adult is 5 to 15 grains, see no public danger in the use of milk for quite infants having as much as 80 grains a pint of boric acid in it?—Eighty grains to the pint, is that not a large quantity?

6561. Very, according to the dose put down by the British Pharmacopœia?—80 grains to the pint is beyond me; I know nothing about the matter from that point of view, but it strikes me as being a very large quantity.

6562. If I tell you, as a fact, that we have had evidence before us that that has been found, do you see in that any reason why the apparently indiscriminate use of boric acid should be stopped?—Yes, I would, if that were not an isolated case. It seems to me that that is like taking tablespoonfuls of salt.

6563. If that is possible—and we have had evidence of doses far larger than the British Pharmacopœia lays down (it is almost, perhaps, an everyday occurrence, certainly for infants), would that modify your opinion at all?—Do I really understand that infants might take much larger doses than those indicated in the Pharmacopœia—that is to say, 5 to 15 grains?

6564. Far greater?—Per day?

6565. Per day?—My common sense tells me that I must hesitate before agreeing with the giving of such quantities, certainly. I should want some more evidence on that allegation as regards every-day experience.

6566. One more point. Take the case of formalin; you have told us that formalin, as we have been told before, is a very active hardening agent?—Yes.

6567. Do you see any objection to the indiscriminate use of formalin in foods intended for infants and invalids?—I certainly see objection to the indiscriminate use of it, but I want to know more about it. I should infer, from what I do know of the action of antiseptics, that a certain quantity, I do not know how much, a minute quantity very likely, in food would preserve the food outside the body, but when you take it into the stomach it would cease to have any action whatever. That would be my inference from my own experiments on other antiseptics, but I know nothing directly about the action of formalin as a constituent of food.

6568. (*Chairman.*) You have not told us anything about salicylic acid. I do not know whether you have had any experience of it?—I do not know much about salicylic acid. I have taken it, and I know it is consumed in large quantities. So far as my experience goes, which has simply been experimental, salicylic acid may be taken in quantities of from 5 to 15 grains at a time without retarding the digestive processes.

6569. The question of idiosyncrasy comes in, does it not, in these matters?—Yes, I dare say, and that is why I was so anxious at the beginning to tell the Committee that my experience was simply personal. It is the experience of one individual, but that individual happens to be a scientific chemist, and these are mostly chemical questions; that really is my most important qualification for appearing before the Committee.

6570. You have given some attention to colouring matters in food, I think?—I have the ordinary experience of a chemist who is applied to by firms for advice and that kind of thing.

6571. Have you become aware of any hurtful agents used in colouring matters?—No, I have not. The question that has commonly been put to me by wholesale confectioners has been—is this colouring matter of which we show you a sample injurious to health? Up to ten years ago I had always answered that question in this way—I am not qualified to form an opinion; but since I have used the stomach tube I have endeavoured to answer the question by the simple method of taking quantities of the colouring matter, and I have never come across a colouring matter that was injurious, that was distinctly harmful, and that distinctly produced any discomfort in any way. That is all I can say. But, unless I have known the source of the colouring matter and something about it, I have commonly refused to entertain the question.

6572. There are some substances which are used which

Prof J. Attfield.

9 Feb. 1900.

are admittedly harmful if they are taken in sufficient quantities—is that not common knowledge?—That is so, of course.

6573. Sulphate of copper, for instance?—I have had some experience of that question of copper in vegetables, though I do not know whether it would be of any use to the Committee. I have been the chemical adviser of a very large firm indeed of wholesale canners of food, and bottlers of food, and preservers of food—people who make jams, pickles, and so on. That firm has put that question to me on some occasions because they have had to import vegetables, chiefly French things—French pickles highly coloured—and they objected to what they call handle them at all—that is to have anything to do with their sale unless they were either free from copper or contained such a minute amount as to be harmless. So I have examined such articles from time to time. I never could find more than a trace of copper in such vegetables, and, indeed, from my professional experience I may say that that copper seems to get in by manipulating the vegetables in copper vessels. I have never yet come across a good case where copper has been intentionally added in order to colour vegetables. It has seemed to me that a minute amount of copper seems to act as a sort of mordant, and to maintain and preserve the chlorophyl or other green matter of vegetables, and that the quantity is excessively minute. In connection with the firm I have mentioned they never used any copper in any way—I mean never added any copper sulphate to colour or anything of that kind, but they, like, I think, all other such firms, have commonly used copper vessels in making jam, for instance. Some fruit juices are acid, and I have wondered whether such preserved fruits would, if examined in considerable quantities, show the presence of copper. I have examined a hundred grammes at a time of such fruits, and got the ash and examined that for copper, and I have only once detected copper in the course of three or four years, examining such jams, perhaps, twice a year. There was a very minute amount, but still I did find it, and so I went into the question. So far as I could ascertain by inquiries in the firm a man had been careless in not cleaning his copper steam pans, and in the upper part—not in the lower part, where the juice boiling with sugar was going on, but in the upper part—there would be a greenness, you know, and I take it some soluble salt of copper formed, and that would have got dissolved, but even in that case the quantity was extremely minute, quite a harmless amount. However, ever after that in my inspection of this particular factory, which I do to this day and have done for twenty years—six times a year, every two months—I have been very careful to look after the copper pans, and I do not detect any copper in the jams.

Mr. CHARLES WALWYN RADCLIFFE-COOKE, M.P., called; and Examined.

Mr. C. W. Radcliffe-Cooke, M.P.

6574. (*Chairman.*) As we know, you are a Member of Parliament?—Yes.

6575. And you are a maker of cider and perry?—Yes.

6576. I think you are prepared to tell the Committee something about the necessity for the use of preservatives which we understand are used in such manufactures?—Or rather their not being necessary—perhaps that would put it better. I have had cider made on my place, according to the records, for 200 years. My father made and sold cider before me, and I have always made cider, and I now make it on a fairly good scale—from 15,000 to 20,000 gallons yearly, or something like that. I have never found it necessary to use a preservative, nor have I heard that any kind of preservative was ever used in the making of cider and perry on my estate. Of course, the Committee know how cider and perry are made. The juice is expressed from the fruit in a mill, either one of the old stone mills—I have several—or in a machine like a turnip-cutter, in which the fruit is cut up and passed through rollers, and the pulp afterwards put in a press and the juice expressed, and pumped at once into proper vessels—large vats. At the time of doing this the juice is tested with the saccharometer or with the hydrometer in order to ascertain the density of it. After a time the first fermentation begins forming a crust at the top and lees at the bottom, while the liquor between becomes comparatively clear. It is then tested again to see what sweetness it has lost during the course of fermentation, and is racked into other vessels, and from time to time this racking goes on until the liquor becomes comparatively bright. But if you want it for bottling you must filter it afterwards, and either pass it through a German filter, which contains compressed cotton pulp, forcing it through by a pump, or else by gravitation, according to your appliances, and that renders it perfectly bright. But at the same time that extracts a great many of the germs of fermentation. I have tried it myself, and found that occasionally the cider will not come up afterwards—it did not last year, for instance—I suppose all the ferment germs were extracted. The process that I adopt (which is a very old process) is that of running it through bags, like large jelly bags, made of a kind of linen stuff, which I think they call Forfar. This is called dropping the cider or perry. These bags are placed in a frame, so fixed that they all run together, and then the juice comes out and is put quite bright into a vessel. Then that vessel is properly stopped down, and attention is paid from time to time, by testing it, to see how the fermentation is going on, and if the fermentation is going on too rapidly removing it from that into another vessel, which for precautions sake you may sulphur—because the vessel may not be quite clean, even with the utmost efforts—so it is desirable to burn a sulphur match in the vessel, before putting the cider or perry into it. If this is done carefully and with attention there is no necessity to do anything else whatever to it. I should say, however, that before filtering the cider in these bags, or passing through this (Lumley's) filter, it is desirable to put some albuminous substance in the cider in order that it may not run too quickly through the bags or through the filter. The albuminous substance that I use is skim milk—about a gallon to a hogshead—our hogsheads running to about 100 gallons, and this is well stirred up. Then it runs much brighter than it otherwise would do. With cider so treated in that way, in perfectly clean vessels, the mill perfectly clean, the vessels perfectly cleaned out, everyone of them washed out, scalded, scoured, fumigated, if necessary, with sulphur—there is nothing else that need be done to either cider or perry.

6577. What is fumigation for?—To destroy any bad germs just as you would fumigate a room if you had the germs of disease in it, so you would fumigate the vessels for the purpose of destroying bad germs. Germs being everywhere in the atmosphere, as we all know, there may be some bad germs about, and you want to have your vessel perfectly free from them. Fumigation also has some effect in stopping the fermentation in the liquor, because, I believe, although I am not a chemist, that it forms something like sulphur dioxide, and ultimately sulphuric acid, and that has an effect upon the cider itself, but not a very great effect; at any rate I have not found it to have a great effect. It cleans the vessels, but has not a very great effect in stopping fermentation. If that is done, and if the fruit is fairly clean and rotten fruit removed there is nothing else that need be done to the cider, and whether it is good or bad cider, or poor or weak cider, will depend more or less upon the quality of the fruit.

6578. May we assume that some manufacturers use preservatives?—Yes, a good many do, but, of course, you will not ask me to mention the names of any?

6579. Certainly not?—Being a cider maker myself, people would say that I disclosed certain practices for my own benefit, or something like that. The preservatives are those with which this Committee is perfectly familiar—they are nearly all preparations either of borax or salicylic acid.

6580. At what period of the manufacture—at what stage—are preservatives added?—They are put in at any time, but what they put them in for is generally to affect fermentation. The first that I have on my list is sugar of boron. I do not know what particular derivative of borax that is, but no doubt it is the same as the others in its effect. I find here that a great deal of this is also used by mineral water companies. The Dorset Mineral Water Company, for example, say: "It is, we may say, exceptionally useful for keeping good and bright all non-alcoholic beverages which we have previously had considerable trouble with." Here is a testimonial from a cider maker: "Please send me one of the original cases of 'sugar of boron' (56 lbs). The bottled cider and perry I treated with it last November is in splendid condition and quite free from deposit"—that is because the fermentation is stopped. Of course, as the Committee

Mr. C. W. Radcliffe-Cooke, M.P.

9 Feb. 1900.

know perfectly well, all liquors in fermentation throw down a certain amount of deposit, and the modern sellers and also buyers of cider and perry want to have something perfectly clear, so that they can turn the bottle upside down without finding the slightest sediment in it. In order to produce that result they stop the fermentation, and, of course, stop the liquor from maturing and becoming wholesome. I find among the testimonials I have here that the French Vintage Company of Mont-le-Grand, Exeter, say—these are all printed, so, of course, they may appear—"Dear Sirs,—Please send me at once another 14 lb. case of your 'Boron,' which we find very useful for our high-class champagne cider.—Yours faithfully, (signed) J. Clarke, manager."

6581. (*Dr. Tunnicliffe.*) Is that a testimonial?—These are from testimonials sent out by the sellers of sugar of boron, so, of course, they are public property. This was sent to me by somebody, I forget by whom now. It is also used a great deal in brewing. The Albion Brewery Company, Limited, Oldham, write: "Please forward us another 56lb. box of the 'Boron,' which we are able to state is of much greater benefit than any other preservative we have used, and you may refer anyone to us respecting the matter if desirable." Then there is a cider manufacturer whom I know who has got his name down on this list. That is all about sugar of boron. There is another preservative which is called by a fancy name, "Cynin." That I had analysed, and it proved to be a solution of salicylic acid and borax in glycerine. It certainly was a very good preservative, as far as keeping the sweetness went. I saw that tried on two small barrels of cider, about twelve gallons each; some was put soon after the cider was made into one barrel and none in the other, and both these barrels were left about anywhere, in the yard, or anywhere exposed, and afterwards in the winter time they were put under cover, and one spring, I think it was last spring twelve-months, they were broached in my presence. The one that had not the stuff in it was quite hard and had lost its sweetness, and also there was a little bitterness about it; while the other was just as sweet, I should say, as when it was made.

6582. (*Chairman.*) Was the hardness arising from the fermentation going too far?—Of course, from the sugar being all converted into alcohol. We call it hard, you call it dry; it is much the same thing. The other was perfectly sweet, as sweet as when it came from the mill I should think. It was quite bright, and you could not detect any taste whatever in it of any sort or kind. But I should say at once that that cider which had got hard and acid to a certain extent ought not to have been left about in that way. It was left about as an experiment, but otherwise it would have been tested from time to time, and if found to be getting too sharp or likely to get sharp, it would have been racked into another vessel, and so would have preserved a portion of its sweetness. At the same time, the cider that had been treated with cynin had not matured in the least, and it was just in the same condition almost as after it was first filtered. There was no maturing, and it was not, of course, nearly so wholesome as the hard cider, the dry cider would be. The next preservative that I have is Walter Gregory's powder. That I have not any testimonials about, but I had it analysed by a county analyst whom I know. He says: "It is almost entirely composed of salicylic acid, mixed with a small quantity of red oxide of iron. The oxide of iron is probably added in order to hide the white crystals of salicylic acid." The Committee, of course, are familiar with the effect of salicylic acid and borax. I do not know whether the Committee are aware that Mr. Lloyd, the Agricultural Chemist of the Bath and West of England Society, the year before last conducted some experiments upon the use of these preservatives, especially borax and salicylic acid, and that he found that in the ordinary——

6583. I am afraid we must get that from him if we get it at all?—That you can get from him if you are going to call him.

6584. I do not know that we are?—At any rate, you will find the information in the last volume of the Journal of the Bath and West of England Society, and I will not say anything more upon that. Then, to go on with my list; formalin, I believe, is not very much used by cider makers. I imagine that to be the case, because, as you will see in Mr. Lloyd's paper, it makes the cider cloudy, and it is difficult to get rid of the cloudiness; besides of course, it is a very horrible drug to put into anything. Then there is a preservative called "K. M. S.," which is a preservative or anti-ferment used by brewers. I have not had any analysed. A specimen was to be sent to me, but it did not come. I suppose they found out to whom it was going. Then there is "Hawkes' Anti-Ferment"; that I had analysed. This is a different class of thing rather from the other preservatives. These anti-ferments, as they are called, or preservatives (they have got different names for them) are to make bad cider good. "Hawkes' Anti-Ferment is mainly composed of calcium sulphite"—this is the analyst's report—"with small quantities of lime. When calcium sulphite comes in contact with an acid sulphur dioxide is given off. The calcium will combine with the acid (say acetic acid), and form calcium acetate. The sulphur dioxide gas will destroy the ferments and will in time be changed into sulphuric acid, which will attack the calcium salts and form calcium sulphate or gypsum. I do not think"—this is the analyst's opinion—"Hawkes' cider restorer is capable of restoring a bad cider to its original good quality. It will (because it contains lime) reduce the acetic acid and cause the liquid to remain constant, that is, it will not ferment." I should say that I have here a pamphlet which might be useful to the Committee as regards formalin as applied to brewing and the manufacture of mineral waters, ginger beer, temperance drinks, British wines, pickles, jams, etc. I have read the pamphlet, and it seems that this stuff is very largely used, especially in temperance drinks.

6585. (*Dr. Tunnicliffe.*) Is that pamphlet issued by the Formalin Company in connection with Schering's formalin?—Yes, and you can have it. It is called "A Treatise on the use of Schering's formalin as applied to brewing and the manufacture of mineral waters, etc." I got a friend of mine to apply for these things, and that was a pamphlet he had sent to him. Then with regard to Hawkes' Cider Restorer, here is a farmer who says: "It is with great pleasure I bear testimony to the excellence of your cider restorer, which I have purchased of you several years, for I have found it to restore cider when it was apparently worthless; one lot so bad that I could not tell what to do with it, but after using the restorer it was so much improved that I sold it for 25s. per hogshead"—that is about 54 gallons in that part of the world—"and many of those who purchased came again for more." Here is another: "The cider restorer I had of you last year I tried on some reamy cider"—that is, stuff that is ropy—"and it acted very well, and made very passable for farm cider which before could not use." The result of that is that cider which is beginning to decompose, and, in fact, is decomposed, by the use of this stuff is rendered palatable, and people are persuaded to drink stuff which is extremely unhealthy, which has already decomposed, and they do not know that it has been in this horrible condition or that it has got into this horrible condition. The flavour is altered, the taste is altered, and the nastiness is taken out of it, but the quality of the cider is entirely destroyed, and you cannot restore it.

6586. Can you, without letting us too far into trade secrets——?—I do not know any trade secrets——

6587. Tell us how far cider is fortified?—No, I cannot. I should not think it was fortified very often—alcohol is too dear to buy to fortify cider with.

6588. What is too dear?—Pure alcohol is too dear. Nobody would do that. I do not think cider is very much fortified; there would not be so much harm in that, but I do not think it is often fortified.

6589. (*Dr. Bulstrode.*) Do you know if preservatives are used more in one part of the country than in another—whether their use is at all extending?—These testimonials that I have read are mostly from Somersetshire and Devonshire, but, I know nothing personally of their use in other parts.

6590. (*Chairman.*) Your own district being Herefordshire?—Yes.

6591. (*Dr. Bulstrode.*) Do you know whether preservatives are used in Normandy for cider?—I do not know much about Normandy cider—Brittany cider I have had.

6592. Are they used in that?—I do not know, and I could not tell you whether that is so or not. The French makers are taking very much more interest in the subject of cider-making than we are. Their books on the subject are very much more valuable than our books are—in fact, we have none, comparatively speaking, compared with theirs.

6593. Is it your position that preservatices in the case of cider are substitutes for the want of cleanliness?—Yes, especially the last class of antiferments that I men-

Mr. C. W. Radcliffe-Cooke, M.P.

9 Feb. 1900.

tioned. They induce people to be careless, and to a great extent there is carelessness in farming, the vessels are not clean, and the things get mouldy, and they do not take care with their fruit, and various other things. Then, afterwards, having made their cider in this careless way by the use of such an anti-ferment as that I last described, they can sell their cider at a fair price, which they could not otherwise do. That I think is a very bad thing. These restorers make palatable stuff in which decomposition has already commenced; the quality has gone before they are added, and cannot be restored, only the nastiness is neutralised and disguised —that is the way I put it.

6594. Do you think the public have any knowledge that preservatives are used in cider?—I should think everybody must now know that preservatives are used in almost everything, but I was going to say I hope they do not know of it in cider, because, perhaps, the trade will be injured.

6595. Do you know that certain cider firms advertise that their ciders are quite pure, and do not contain any chemicals?—Yes.

6596. You know that?—Yes, and I know that some of them add these things.

6597. Add these preservatives?—Yes, though they say they do not.

6598. You do not think the use of the term "no chemical used" is meant to imply "no preservatives used"?—No. I should certainly have an indication outside the bottles or vessels; they ought to be marked outside, "This has been treated with boracic acid," or "This has been treated with salicylic acid," or "This has been restored with so and so."

6599. May I read you this of a certain cider—it is "guaranteed to consist only of the pure juice of Devonshire apples; no water, chemicals or saccharine are introduced; nor are these ciders artificially aerated"?—Of course, that ought to be good cider; that describes good cider.

6600. Without preservatives?—Of course it does. It says nothing as to any preservative.

6601. Without that may one take it that a statement such as this is meant to imply that no preservatives are there?—It is intended to imply that, and then if you had that cider analysed and found there were preservatives used in it you could have the seller up, of course, under the Food and Drugs Act.

6602. Do you think if preservatives are used in cider that the name and nature of the preservative used should be stated, and the amount of it used?—I do not think you could state the amount because it would be rather difficult to say the amount in a bottle, but you might say that preservatives had been used, or something to that effect; you might state the preservatives, or you might simply say that preservatives or a restorer, such as the last one I mentioned, had been used.

6603. Can you hand in to the Committee those testimonials and printed advertisements?—Yes (*handing in leaflets*).

6604. (*Dr. Tunnicliffe.*) Do you sterilise your pans or your vessels, I should say, by sulphur?—Yes, on occasions. I do not do it if they are perfectly clean; I do not think it is necessary.

6605. What test have you whether they are perfectly clean or not?—I have no test. I simply see if the vessel is scoured out well, and if the head has been taken out of the cask I look inside and see that it is perfectly clean, or some of my men do, but I very often do it myself. I do not want to stop the fermentation entirely, and I am satisfied that fumigation has little effect in stopping fermentation.

6606. You see no objection, do you, to sterilising the vessels with sulphur?—No, I do it myself; I see no objection to it.

6607. Do you see any objection to the use of formalin or boracic acid?—I do not know enough about those drugs to be able to tell you their effect, but I should not use them myself, because from all I have read and heard of both, especially formalin, they are very deleterious drugs. Sulphur has been used for ages, and apparently has no effect whatever on the health, used in that way.

6608. What I wanted to ask you is whether your objections would apply to the use of preservatives for sterilising purposes, or whether they would apply only to the actual addition of the preservative to the substance when it is made?—I object to the use of these sterilising drugs, because they stop the fermentation, and therefore stop the maturing of the cider, and also because I believe them to be harmful. If you were to sterilise apple juice you would never get cider.

6609. I am speaking of the vessel now?—Speaking of the vessel, the reason why I sterilise, as you call it, or sulphurise rather, my vessels, is because I know that there are germs of all sorts about floating in the air, and you cannot wash every vessel out at the very moment when you are going to put fresh cider in it, and therefore to make sure there are no bad germs in the vessel I burn a sulphur match in it before I put the cider in, not so much to sterilise the ferment, not so much to prevent the liquor I put in from fermenting as to destroy any bad germs that may be in it. That is the main object that I have. Of course, you know that cider is sterilised. A great deal of the cider that is sold is sterilised by heat. It is heated up to about 150 degrees, but then after that you must carbonate it. Carbonic acid gas has to be forced into it in order to give it the fizz, which it would not otherwise have. That, of course, you know, but I do not like that process, because I think the sterilising destroys the quality of the cider, and also that the carbonic acid gas that is forced into it is not the same as the natural gas that is produced in the process of fermentation.

6610. (*Chairman.*) Did you say 150 degrees Fahrenheit?—Yes, about 150 degrees Fahrenheit. If it is subjected to the heat for some considerable time then 140 degrees would do, but if for a shorter time then it should be 160 degrees. The carbonic acid gas that is forced into it afterwards does not contain the ethers which originate in the course of the natural fermentation and the natural production of carbonic acid gas. You see to those ethers the quality and the taste of cider are mainly due.

6611. (*Dr. Bulstrode.*) Have you any reason to suppose that cider merchants who do not use preservatives in their cider, if the use of preservatives is not stopped, would eventually in self-protection, or as a matter of survival, have to use preservatives?—No.

6612. None?—I do not think so at all.

6613. Have you any reason to suppose that the non-use of preservatives would be detrimental to those who use them now?—Of course it would be; it would stop a good many people turning bad cider into palatable stuff, which is what we want to do; but it would not affect the honest trader, and it would be a great deal of benefit to him.

TWENTY-THIRD DAY.

Wednesday, 2nd May, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.

H. TIMBRELL BULSTRODE, Esq., M.D

CHARLES J. HUDDART, Esq., *Secretary*

Mr. A. S. Lough.

2 May 1900.

Mr. ARTHUR S. LOUGH, called; and Examined.

6614. (*Chairman.*) You are a member of the Irish Agricultural Organisation Society?—Yes.

6615. And you are connected with numerous other dairy societies?—Yes.

6616. You are Managing Director of the Cavan Creameries, Ltd.?—Yes.

6617. You also own a private creamery?—Yes.

6618. I believe there has been great activity in setting up the creamery industry in Ireland of late years?—Yes, a most extraordinary revolution has been accomplished there.

6619. Can you give us an outline of the facts?—Yes. In the south of Ireland the industry commenced about eight or ten years ago and in the north of Ireland about two-and-a-half years ago, and in that time we have established between 500 and 600 creameries in Ireland. Of that number the co-operative creameries which I have been principally interested in as a member of the Organisation Society have established about 260 co-operative creameries in the country. In Ulster the revolution has been more extraordinary than in any other part of the country. Ulster was not very much noted as a dairy district some time ago, but now, in the last three years, we have got in Ulster 108 co-operative creameries working and thirty in course of formation. The fourth co-operative creamery established in Ulster was the Killeshandra Creamery, which I was president of and which I started, and that creamery had a turnover of £3,500 in its first year, 1897. In the following year the turnover was £9,000, and in 1899 it was £17,500; and this year we estimate the turnover will be £25,000.

6620. That constitutes a pretty general revolution in the Irish dairy system, does it not?—An extraordinary revolution.

6621. To what extent do these creameries as a rule rely upon the use of preservatives?—Nearly all the creameries at present use preservatives in summer. Some do not use them, but the majority use preservatives.

6622. Do these co-operative creameries manufacture butter?—Yes, only butter. We make no cheese and we sell very little cream. It is all fresh butter. It is called fresh, but, of course, it is a week or so before it is used by the consumers.

6623. What do you do with the separated milk?—It goes back to the farmer. The separation takes place immediately the farmer comes to the creamery with his cart of milk, and it goes back to the farmer the moment it is separated. He waits for it.

6624. What does he do with it?—He feeds his calves. The calves in the north of Ireland and round the district which I know most about are a great source of profit, and the milk must be very carefully separated and handled.

6625. You have not found it impossible to handle your butter without preservatives, have you?—Certainly. One of the reasons that we use preservatives is because we have been asked to use them by the wholesale firms. As a mater of fact, a far less quantity of preservative might be used than is used. It has been treated practically as a salt. I think I can speak for the Organisation Society, for it gets the reports daily and weekly of these creameries, and, to my knowledge, we have never had any complaints regarding the use of the preservative in butter—never the slightest. As a matter of fact we will do without preservatives in the creameries in which I am managing, and simply because we think we will get a little higher price. That is our intention.

6626. That is to say, that you could make the butter and get it off your hands without any preservatives, but the wholesale dealers require to keep it longer than it would keep sound without a preservative. Is that it?—That is it exactly. We find that there is not a demand for it without. I suppose the wholesale dealers find there is not a demand for a huge quantity of what might be described as saltless or fresh butter, and, consequently, they want the butter to stand a certain time, and we make the butter to suit them. On the other hand, if the development goes on with regard to fresh butter that has commenced it is very probable that preservatives would naturally be used less. We try to get butter into consumption quicker from Ireland, and we are able to do this now by the revolution in the creameries that has taken place. We get a better price for the butter that is put in the market and used fresh.

6627. Witnesses from Ireland have complained very bitterly of the delays in the traffic from imperfections in the railway and steamboat service?—Excuse me for one moment. I should like to say that there is a distinction that should be drawn between the north and south of Ireland with regard to this system of preservatives and pasteurising. In the south the system is that the cows should be arranged, as far as possible, to calve, from March, say, to the 1st of May, but in the north of Ireland we are not so particular about this, because we winter-feed more in the north. So that in the south the necessity for pasteurising perhaps is not so keen as in the north, for this reason—that the cows calve so far as we can determine it more regularly. They are arranged to calve between March and May in the south, so that the farmers shall not have winter feeding—that is to say, they will not have winter milk to the same extent that we have in the north. Now, in the north we do a great deal of winter feeding, and if you feed in houses you cannot get as good a flavour in the butter unless you pasteurise. It is not easy to get it. It is just the same as in Sweden and Denmark, where it is practically essential and necessary, that they should pasteurise, because they have their cows house-fed for eight or nine months. It is not natural to assume that those cows, no matter how carefully fed in the house, would produce butter as good as butter from grass-fed cows, and of necessity to get the best butter where cattle are so long in the house you ought to pasteurise. Now, we have come to the north of Ireland, where we feed cows in the winter and produce a good deal of butter in the winter. In the north they work all the winter, but in the south of Ireland a great number of the creameries shut down during the winter, therefore we are intermediate between Denmark and the south of Ireland. They must pasteurise to produce good butter, but we come in and say we will do both.

6628. Who must pasteurise?—The Danes must to produce the best butter, because the cattle are so long house fed.

6629. On what is that statement founded?—For instance, I keep a lot of cows myself, and I make winter butter. If you do not turn out your butter very promptly and get it into consumption in a couple of

Mr. A. S. Lough.

2 May 1900.

days, or if you happen to use mangels or turnips, you can hardly avoid a house-fed flavour in your butter, and pasteurising will remove that to a great extent. Now take the other position which is that I have my cows out in grass in summer, and in which they are milked in the field, as they are in many places in the south of Ireland. The milk can is in the field, and the cart takes the can from the field to the creamery each morning and evening. Now, that butter should require no preservative, or pasteurising, but it should be the best butter for prompt consumption.

6630. Are you dealing with pasteurisation solely as a means of purifying the flavour of the butter?—As keeping it pure, so to speak. We all know that if cows are milked in a house, and if the can of milk is carried from that cowhouse to the dairy, the time of passage through the house and the time it remains in the house, especially in the cowhouse where the milking takes place, is the time that most of these organisms are developed and where they most rapidly develop.

6631. Would you be surprised to hear that some witnesses from the south of Ireland have alleged pasteurisation in Denmark as a reason for the inferiority of the Danish butter flavour?—I would not say so.

6632. You do not agree with that?—No, not at all. I believe pasteurisation is most valuable, and I do not agree with that statement.

6633. To what temperature do you raise it in pasteurisation?—175 degrees to 185 degrees Fahrenheit. That is about the temperature used. We are putting up ice-making plant and cold storage plant, and of course that makes it much easier to do it in case we wish to stop using preservatives—in case it was necessary or that the result of this Committee was that they should have to be done away with.

6634. Are you aware that there are other methods employed of improving the flavour of milk and cream from house-fed cattle?—Besides pasteurising it?

6635. Yes?—No, I am not aware of it.

6636. You have not heard that the introduction of certain ferments or cultures is employed?—With regard to that, if you pasteurise cream you must use a pure culture to ripen it to make butter, but I never heard of any way of improving the milk of house-fed cattle by that means. It is to ripen the cream after it has been pasteurised that we use the cultures.

6637. I interrupted you just now, I think, to ask you about the complaints we have had from the south of Ireland as to difficulties of transit by rail and sea. Have you experience of that in the north of Ireland?—Indeed we have. It is the greatest curse practically that we have got to deal with in Ireland. For instance, we get no suitable wagons for our butter. The wagons that the butter is put into may be cattle wagons or wagons that have got any sort of goods to carry for local stations. There is no such thing on an Irish railway as a refrigerator car at the present moment, I believe. I know this as a fact that has come under my own observation that a large quantity of butter was being sent from the Killeshandra Creamery in August. The wagon that it was put into was just pulled in out of the sun. It was not even standing in a shed. The butter was put into it and it was not a clean wagon. That butter came across to London, and a couple of days afterwards we heard that it was very bad and very inferior. Butter sent the same day to Belfast was quite good and quite sound, so that it must have been owing to the difference between the two methods that the butter was damaged in transit.

6638. Have representations been made to the various companies on the subject?—Yes, we have made representations, and probably we will get some assistance presently, because we have got a new Agricultural Board there, and it will be able to bring pressure on the railways I hope.

6639. You have already explained that the development of the trade has been very rapid?—Yes, with regard to creameries it has been so, but there has been always a lot of butter of the old style bought in the local markets. We are now concentrating the thing more so that it would be easier to deal with it. Then there is another matter. For instance, if we send our butter by the ordinary goods train it is a very slow business to get it into London or Manchester from the centre of Ireland. There is no comparison between that and the speed with which Normandy butter is got into the English markets. For instance, butter put on rail on goods trains at Killeshandra, Cavan, or Clonas should be in London within two days, that is, butter put on rail say on Wednesday evening should turn up on Friday morning in London. Now, that is a very simple statement, but on the Midland Great Western Railway of Ireland if there is any big fair on within any reasonable distance, everything is put aside—traffic is dislocated and butter delayed. These railway commissioners that you have in England are the theoretical body that we should have to influence the railway companies, but I do not think, as far as my knowledge goes, that we have had a single case where they have ever given the slightest assistance to us.

6640. Are there any traders' wagons in the butter trade?—No, none in the north of Ireland, and I know of none in Ireland.

6641. You think they would be able to help?—Certainly they will be a help. Another thing is most extraordinary, that is that there is some new Act of Parliament or some re-arrangement by which you cannot proceed for compensation against the railway companies in an easy way. Supposing we are sending butter to Brighton from Ireland, it would probably pass through the hands of four different companies. If the butter was damaged by the third company that got it we would have to proceed against the first company. They would prove the delivery to the second company. The second company would prove delivery to the third company, and then we should have to pick out which of the four companies had damaged the butter and proceed against that company. Anything more idiotic for business firms to have to deal with than that you can hardly imagine. It is a most extraordinary position. We had a case like that at Killeshandra. We got the receipt from the Midland Railway Company and proceeded against them. They proved delivery to the Northwall Boat. Then we had to proceed against the London and North-Western Company—a most troublesome business—and the company that has received the butter is not bound to say who has damaged the butter. That is a most unsatisfactory position. We were defeated and appealed the case, and it was contested, and we were beaten.

6642. What is your experience as to factory butter?—I never had anything to do with it. We do not touch that at all in the creameries.

6643. Are there any butter factories in the north of Ireland?—There are, and they are a great source of difficulty with regard to the butter business, because there are factories at the present time in the north of Ireland which buy up butter in the local markets and bring it to some town where they have got what they call a blending establishment. That butter is blended there, and after it is blended it is packed identical with our creamery packages, and no brand is put on it at the town where it is blended, but a brand appears on that butter in the English market, and as a matter of fact it is very often sold as creamery butter.

6644. Is there any reason why it should not be sold as creamery butter?—It is not creamery butter, it is butter bought in the local market.

6645. Has creamery a definition?—Yes. This practice is misleading. For instance, we brand all our butter—at least the co-operative creameries do that do their business right—"Guaranteed pure centrifugal creamery butter," and they could, as you indicate, put that same brand on and not come within the law—you could not take proceedings probably against them, because it is made from cream, and they use a table that is centrifugal in its action, but it is very different butter.

6646. Do you look upon factory butter as inferior to creamery butter?—There is not the slightest doubt about it. Everybody knows that—I mean everybody in Ireland, in these districts, knows it well.

6647. Is not one of your most formidable rivals the Normandy factory butter?—That is a very different thing. I am very glad you asked me that question, because there is a great misapprehension in most people's minds with regard to that. Factory, or milled butter as we call it in Ireland, is the butter bought from the farmers in the local markets who still make the butter in the old way. For that butter the average price in the local markets is 2½d. per pound, or 23s. 4d. a hundredweight less than creamery butter in the same locality. It is salted butter that has been kept in the house for a long time and could never be classed as fresh butter under any circumstances—quite the reverse. That butter is brought to a blending establishment, and they make it a more even thing in quality, and may improve it

Mr. A. S. Lough.

2 May 1900.

in other ways, and it is sold then as creamery butter. In the Normandy system the farmers churn their butter, and as far as I understand it they do not put salt in it even, and it is immediately collected and brought to the blending establishment. That is a butter made on an entirely different system from the milled butter, which means butter which has not been immediately churned, and it is also butter that has been churned under the most unfavourable circumstances, because it is done under the old system at little farmhouses with no proper dairy for doing it. It is quite a common thing in Ireland for cream to be collected in the dwelling rooms of the cottages, and there is no more shocking system than that—it is most dangerous. That butter is called milled or factory butter in Ireland. There are a few factories in Ireland where the Normandy system prevails.

6648. What do you say about colouring matter in your creameries?—That is hardly used at all.

6649. Is the winter butter the same colour as the summer butter?—Very nearly. There are some dairies that use annatto. They use it in very small quontities. The dairies that I know most about in the north of Ireland I think hardly use any.

6650. But your winter butter will naturally not be the same colour?—It is astonishing how little difference there is. I was in the Killeshandra Dairy; it was in the month of March, and they were making butter, and I went to speak to the dairymaid and said: Do you use any colouring matter; and she said No. You would not want butter of any better quality or colour.

6651. What cows are they?—They are of mixed breed—crossed, Shorthorns, and others.

6652. No Channel Island cows amongst them?—None. Annatto might be used. They keep annatto in most dairies. A very little mistake in the scalding may cause them to want it. It is, of course, not as deep in colour as the summer butter, but it is of very good colour.

6653. You do not find the wholesale dealers like a uniform colour summer and winter, do you?—Really I do not think there is a great deal of difficulty as to the colour. In some places in England and Scotland they want it deeper in colour than others.

6654. Are you acquainted with Denmark—have you been in Denmark?—No.

6655. But you are acquainted with the system, are you not?—Yes, I have met a lot of Danes and experts from Denmark.

6656. The cows are kept in the house eight or nine months a year, are they not?—Yes. I have a Dane working for me at the present time, and he says that the time would be eight or nine months.

6657. Would you say that the Irish enjoy a great advantage over the Danes in that respect?—Certainly. Our cows, I should say, are in the house from four to six months.

6658. Therefore, if your trade were well established, and thoroughly well organised, may we assume that the restrictions which are placed on the Danish producer in regard to the use of preservatives would not be too onerous for the Irish producer?—Certainly not on the conditions you state. It will take some time just to get it organised.

6659. (*Professor Thorpe.*) I gather that the tendency of your evidence is to deprecate the use of preservatives in agricultural products?—Quite so.

6660. Do you think, by due attention to cleanliness, and, if necessary, by the use of pasteurisation, the use of preservatives could be entirely obviated?—In a short time—in a few years with proper organisation, as the chairman has stated. That is in the creameries of the country.

6661. But assuming that the system, however, was organised, and assuming that the organisation you have spoken of, the Irish Agricultural Organisation Society, had some sway, do you think it would be no hardship to the whole of the Irish butter producers, whether they be factory or whether they be creamery, to do away with the use of preservatives?—Personally I would be in favour of doing away with it, but as to it being a hardship it would take a considerable time before it would not be a hardship. There are some districts in which it is very hard to get creameries established, and it would be unfavourable there.

6662. In the meantime, before that happy time comes, perhaps it would be an advisable thing or an expedient thing to require the butter producers to declare the presence of preservatives in their butter?—On that subject it seems to me theoretically a very nice thing to say, and it is the first thing that would occur to me to say, but, on the other hand, it would be, I think, better if it were left like other food products so that you should limit say the quantity of preservative used, and that the different analysts should undertake to declare whether it is injurious or not or something like that. It would handicap the trade a good deal, I am afraid, if you did just say plainly that you must declare whatever preservative you use.

6663. How does it handicap the trade?—For instance, supposing a man discovered a harmless preservative and that he used it, it being absolutely harmless, would it not be rather hard on him if he had to say what it was?

6664. But are not you rather begging the question when you assume that the preservative can be harmless?—I would rather hear men better up in the exact subject—chemists and others—say about that. If it is declared harmful, I, for one, should say it should not be used. That is just the point.

6665. Of course, the term harmful is a question of degree. How do these preservatives do their work as preservatives do you imagine?—As a preservative I should say that they stopped corruption, so to speak. You might put it in that way, although it is a rather coarse way of putting it. They hold back decay.

6666. But is it not the fact that they work by virtue of their action upon the organisms which induce these changes that you call corruption and decay?—Yes, very probably.

6667. Then are not those or similar organisms at any rate concerned in every digestive process?—I should say they are, but it is hard to say that a thing that has been used so long, and that you hear no complaints of in any shape or form, is harmful. We use poisons every day, and without the poison some food would be of little value.

6668. Confining our attention for the moment to butter, surely any process that arrests the action of digestion must be to some extent, at all events, a harmful process?—Being an unprofessional man I should be inclined to agree with you.

6669. Then if you can do without, as you seem to say you evidently can do without, the use of preservatives, and if you are inclined to admit that the action of preservatives is to limit the process of digestion, surely the consumer is entitled to know whether or not he is eating something which has been more or less dosed with an antiseptic?—I know, if I were the man eating it, I should like to know that.

6670. You would like to have that made plain?—Yes. Personally I have no objection, and I think it is quite right.

6671. You think it is quite right, then, that the use of preservatives should be declared?—It is quite right that it should be known that preservatives have been used.

6672. But how is that to be known to the consumer unless it is declared on the article that he is buying?—You did not quite catch my point. For instance, there are preservatives that everything you have said would apply to, but I think there are preservatives that what you have said might not apply to.

6673. Let us confine ourselves to the preservative which is actually used, which is a mixture of borax and boracic acid. The action of borax and boracic acid is to retard the process of digestion to a certain extent?—From the evidence given before the Committee I think that is so.

6674. Therefore if the mixture of borax and boracic acid has that influence upon the digestion, surely the consumer has the right to know whether his food is being dosed with that substance?—Yes, but is not that being done by the analyst?

6675. But the analyst expresses no opinion about that—it is not his business. His business as an analyst is to find out whether these things are or are not there. Now, if it is the fact that borax or boracic acid has this effect, surely the consumer has a right to know he is being dosed with that substance, has he not?—Yes, certainly, but I do not think I would make an exception as regards butter compared with other foods.

6676. Your meaning is on the question of butter?—I am in favour of having pure butter without any

Mr. A. S. Lough.

2 May 1900.

preservatives, good, bad, or indifferent, and the creameries in which I am interested, and which I have assisted to establish—and they are a good many—are preparing to do without them absolutely.

6677. (*Dr. Bulstrode.*) In describing the methods which are adopted by the co-operative creameries in Ireland, you do not mention the regulations with regard to cleanliness and with regard to washing the milker's hands and the udders of the cows and so forth, prior to the milking, but is that insisted upon by the creameries now?—Yes. As far as we can possibly do it we are most strict and most anxious to carry out that very idea. We issue to every milk supplier a very carefully prepared leaflet, just dealing with the facts as you have stated them, and saying that the udder of the cow should be washed with a flannel cloth, and that the hands of the milker should be washed before commencing milking, and also other things, namely, to take the milk out of the cowhouse when one cow has been milked and not to leave it standing till the others have been milked—keep your milk in the open air as much as possible, and do not bring it into the house. We also put all our milk into cans that are watertight with the lids on, and we ask them to leave them out under a tree instead of in the houses.

6678. What steps do you take to ascertain the purity of the water supply to each of the farms?—We never do anything as regards that, I am sorry to say.

6679. Nothing so far is done?—Nothing so far is done, but in the north of Ireland the water supply is good—there are so many running streams and pools. Unfortunately we get a little too much of it in a way.

6680. Is straining insisted upon at the farms?—Yes.

6681. Could you tell the Committee the nature of the preservatives chiefly used?—Borax chiefly.

6682. You say, "I have no doubt but that butter made from unpasteurised cream and treated with preservative will keep longer than butter not so treated." Is that a general statement, or have you any experiments to speak from?—Personally, I have made no experiments, but I know a large number of men, the managers of creameries, who have made experiments, and that is the conclusion we have arrived at. I have had experiments carried out.

6683. You think that if preservatives were prohibited at the present moment it might dislocate the trade for a time?—It would give a great deal of trouble.

6684. But you would not think that was an argument for the use of preservatives provided the Committee came to the conclusion upon scientific evidence that their use is harmful. You would say that the trade must adapt itself to it?—It would be a great labour in many parts of Ireland to do it, but I suppose it must be done.

6685. You say that if such precautions as you advise and illustrate were taken that the use of salt might be dispensed with?—Yes, if the butter came into immediate consumption, certainly; but you must have it more or less if you want to keep the butter for any lengthened period.

6686. As regards the Irish trade, do you think it possible to dispense with the use of salt?—No, I am afraid not. Cold storage is not developed enough, and transit arrangements are too bad.

6687. They are infinitely worse than they are in Denmark, I suppose?—I should certainly say so. The Government give a lot of assistance in Denmark. We have got none in Ireland.

6688. Do you know anything as regards the cream trade?—A little. We do something in the cream trade.

6689. Is it your opinion that the cream trade can be carried out without the use of preservatives?—I should not like to give an opinion upon that subject. I am not sufficiently well up in it. We have sold cream without any preservatives used in it, but it wants to go into consumption very promptly.

6690. You have no objections, as a practical man, against the use of pasteurisation?—Certainly not, except the trouble in establishing it, and the necessity for dealing with large quantities of milk, and that is a very great practical difficulty, but we are overcoming it.

TWENTY-FOURTH DAY.

Monday, 7th May, 1900.

PRESENT:

Professor T. E. THORPE, F.R.S., in the Chair.

H. TIMBRELL BULSTRODE, Esq., M.D.

CHARLES J. HUDDART, Esq., *Secretary*.

Dr. ROBERT HUTCHISON, called; and Examined.

Dr. R. Hutchison.

7 May 1900

6691. (*Dr. Bulstrode.*) I think you are connected with the London Hospital?—I am assistant physician at the London Hospital.

6692. Have you been deputed by the London Hospital to give evidence before this Committee?—No, not so far as I am aware; I was deputed by Great Ormond Street, with Dr. Still, to give evidence.

6693. You have, I think, certain experiments to put before the Committee. Will you kindly put them in your own way, in the first instance?—I do not know that I am prepared to say much about the effects of preservatives on children. The only preservatives that I have tried on myself are boric acid and borax. I made some experiments on the effect of boric acid on the acidity of the urine; I happened to be making such experiments when I got a notice asking me to give evidence here, and then I extended these experiments with a view of seeing what would happen if one took the drug more continuously. The net result was pretty well this—that even such a dose as ten grains of boric acid, taken twice a day on a full stomach by myself for a length of time up to a fortnight continuously, had practically no effect at all. I observed no bad effects.

6694. No bad effects. In what way?—There was no sort of stomach irritation or intestinal irritation or discomfort, or anything of that sort at all.

6695. As far as you are aware, you are quite a healthy individual, and you have no departure from the normal in any way which would modify the effects?—None at all. I think I may regard myself as perfectly healthy. If I have a weak point at all it is my stomach. My stomach is perhaps more irritable than the average; so if it produced any effect one would have expected it to produce vomiting in myself as much as in the average man, anyhow.

6696. This went on for a fortnight?—Yes.

6697. You observed no bad effect whatever on yourself?—None at all.

6698. Have you made any other experiments with regard to the administration of borax?—I took small doses of borax and boric acid solution—five grains—which I believe is a frequent preservative used.

6699. Yes, it is?—That continued for the same length of time had also no effect.

Dr. R. Hutchison.

7 May 1900.

6700. Was it five grains of the mixture?—Five grains in the mixture—2½ grains of each. That was taken twice a day, so ten grains of the mixture were taken.

6701. What do you infer from your own personal experiments in the matter?—I should have inferred that the amount of boric acid or borax which would be sufficient to preserve the quality of milk that an adult would be likely to take in the course of twenty-four hours could not, in the average healthy man, produce any signs of bad effects.

6702. You know that there are certain cases on record in which the continued use of borax or boric acid has apparently produced harmful results?—Yes, I have read of such cases.

6703. Have you prescribed those drugs in your own practice much?—I have prescribed borax for epilepsy sometimes in adults, but not very frequently. It was in hospital out-patient practice; there it is difficult to keep an eye on one's cases. I never noticed any bad effects for the comparatively short time that one was able to be certain of having the people under proper observation.

6704. Did you notice any good effect?—I gave it combined with bromide, and it was difficult to be sure to what extent the good effect was due to the bromide and to what extent it was due to the borax. In those cases of epilepsy unquestionably one saw a great diminution of the fits; but, of course, the bromide alone might have had a great deal to do with that. Still, I had the impression that one got a greater effect than if one had given the same dose of bromide without the borax.

6705. We have had it in evidence before us by several witnesses that the administration of boric acid or borax is contra-indicated in certain conditions, particularly diseased conditions of the kidneys. Have you got any information which would tend to support or to contra-indicate that conclusion?—I am afraid I have not, and I do not think I should like to express an opinion about that.

6706. Boric acid is excreted by the kidneys, is it not?—Yes, it is excreted by the kidneys.

6707. And if the kidneys were diseased you would suspect possibly that some bad effect might accrue?—Conceivably, it might in an acutely inflamed kidney; I think it might be expected perhaps to increase the congestion a little; but, on the other hand, it is so much diluted by the urine by that time, that I should think the effect would be very small.

6708. Do you know the experience of Dr. Bond, of Westminster Hospital? He gave evidence before us chiefly as to the harmlessness of boric acid, but in certain cases he told us he had had bad results, and in those cases the kidneys were diseased, and he had to stop it. Have you any information of that kind?—No, I have no information on that particular subject.

6709. It is also stated by Sir Thomas Lauder Brunton that the administration of borax is attended with danger in pregnancy; have you any evidence in support of that statement?—I did not know that it had any specific effect any more than anything else that is apt to produce irritation of the intestine.

6710. He says: "It has been supposed to have a special action upon the uterus, and has been employed in amenorrhœa, dysmenorrhœa, and puerperal fever and convulsions. On account of its asserted power to increase the uterine contraction it ought either to be avoided or employed with care during pregnancy"?—I have no personal information on that, as far as I know it is not often used.

6711. You have no information on that point?—None at all.

6712. Have you any more evidence as regards your own experiments with reference to boric acid or borax?—No, I am afraid I have nothing else that would be of any value.

6713. We have been told before this Committee that as much as 80 grains of boric acid have been discovered in a pint of milk. Would you as a physician see in that any danger?—Yes. I should not like to take 80 grains of boric acid in a dose.

6714. Of course, this is in milk?—Even diluted with a whole pint of milk I should not care to swallow so much at once.

6715. Do you see any danger in giving a child three pints of milk with we will say 10 grains of boric acid in it per pint?—That is 30 grains in a day?

6716. Yes?—I could easily understand that it might be dangerous in the case of children, whose intestine is more irritable than that of an adult.

6717. Do you think it is possible that the use of preservatives generally in milk might tend to veil the effects of partial decomposition?—No, I cannot see why they should. I mean the only way in which one can judge the decomposition of milk surely is by its becoming sour.

6718. You do not think the addition of preservatives would tend to veil decomposition at all?—I cannot think so.

6719. Do you think that the use of preservatives is in the interests of the public health or not?—I should say yes, because I think the amount of disease produced, especially in children, by allowing milk to go at all bad is probably greater than the amount of disease produced by the use of the preservatives.

6720. That would rather apply, would it not, if the preservatives were applied directly the milk were drawn from the cow?—It would more strongly then, but even if the preservatives be added to the milk later, I think that probably it would do less harm than the milk having become at all turned would do, because then it is very apt to excite diarrhœa in children.

6721. You would rather have preserved milk than decomposed milk?—Certainly.

6722. Would you advocate the continuation of the state of affairs which obtains at present, that is to say, that the use of those things is one may say absolutely unrestricted, as as much as 80 grains of boric acid have been found in a pint of milk?—Of course, that is a state of things which one would like to render impossible, because 80 grains is a quite unnecessary amount for the mere preservation of milk.

6723. Would you suggest that a maximum should be fixed for each of those preservatives?—Yes, I think that that probably would be the best practical way out of it. No doubt the ideal thing would be for milk to be carefully preserved—sterilised or pasteurised—immediately after it was drawn without the addition of any chemical preservative; but that, I suppose, is unfeasible.

6724. Would you as having a great experience of the Children's Hospital, see any objection to the use of sterilised milk for children?—No, I think its advantages enormously outweigh any disadvantages which have been attributed to it.

6725. Quite sterilised milk, I am talking of?—Yes.

6726. Do you think the difficulty would be met by pasteurisation?—I think pasteurisation would do a great deal of good; it would kill most of the disease organisms, and would preserve the milk from going sour for at least a considerable number of hours.

6727. Amongst hospital physicians do you think this question of the use of preservatives in food is regarded as a serious one from the point of view of the profession?—No, I think there is very little attention paid to it. But then of course in hospitals we get probably the better supplies of milk; we get our milk from the better dairy companies, and they know, I suppose, that they are expected to supply us with a fairly pure article.

6728. Do you think that this question of preservatives is a matter of at all serious concern to the hospitals?—I should say not at all; I should say in out-patient practice at the Children's Hospital, and my colleague, Dr. Still, will agree with me, the question of the probability of food preservative being the cause of intestinal irritation almost never comes into one's head.

6729. Have you never looked at it in the light of the presence of the preservatives somewhat stultifying the physician's practice?—I do not think so, because one finds that by modifying the milk in some other way, the mother still continuing to get it from the same source, you are able to make all the symptoms usually disappear without considering the question of changing the supply of milk.

6730. Suppose, for instance, when a physician goes round the wards, he prescribes, we will say, 5 grains or 10 grains of boric acid, would not his practice be rather stultified if it turned out that in the milk there might already be 20 grains of boric acid?—Yes, of course, it would in that sense.

6731. With regard to the use of salicylic acid, would it not be rather a serious matter if a physician in deciding whether he should prescribe 15 or 20 grains found that already the patient was taking perhaps 10 grains a day in addition?—Yes, unquestionably it would.

6732. Does it not rather affect the medical profession in that sense?—It does, of course, in that sense.

6733. Not only in the hospital perhaps, but also in practice outside?—Yes, even more I should think outside. But then, of course, that is only where you are using those same things as drugs which are also used as preservatives; I mean if you are ordering salicylates for a patient it would not much matter whether there was a moderate amount of borax or boric acid in the milk.

6734. But it would matter if you gave him the same drug?—Yes, it would matter because then you would get double the effect.

6735. In other words, would you say as a medical man that the indiscriminate use of drugs for food preservatives is or is not a serious matter for the medical profession?—That is just one of those questions to which it is difficult to give one reply. It depends entirely on the amount in which they are used. I should say that if the amount was strictly limited it would not be a serious matter.

6736. I said the unlimited use; the uncontrolled use I intended to say?—Certainly—there can be only one reply to that. The uncontrolled use would be a bad thing from the point of view of medical men.

6737. With regard to salicylic acid, could you tell the Committee as to whether there are any conditions which contra-indicate its use as a drug?—It is a depressing drug. I have seen it produce great cardiac depression, and one has to use it, I think, with some care in conditions in which there is great feebleness of heart. That is, I think, the only condition that presents itself to my mind where one would be careful of its use.

6738. Would you use it in diseased conditions of the kidney?—One so rarely is known to prescribe it there. If you had a man with acute rheumatism and at the same time an acute nephritis, which is a very rare combination, one might have to consider seriously the question whether the salicylic acid would not injure from the point of view of the nephritis. That is a question which, as I say, in practice hardly ever presents itself to one.

6739. Take the case of a number of people who are not coming under medical treatment whose kidneys may be diseased before they come under treatment; do you see any danger to the public health in their taking considerable quantities of salicylic acid unknown to them?—I should think the danger was very small, because those forms of kidney disease which are not under treatment would be very chronic forms, in which I should think salicylic acid would be the least likely to do harm; I should think it was in the acute forms of kidney disease it was most dangerous.

6740. Do you know anything as to the use of formalin?—Nothing at all, except I am told it is pretty largely used now.

6741. Do you know anything as to the effect of formalin?—No; I have never had occasion to administer it by the mouth; of course, it is an exceedingly irritating substance locally, and one might expect it to have bad effects.

6742. From what you know of the effects of formalin, would you advocate its use as a preservative?—That depends entirely. The amount of formalin required to preserve milk, for instance, may be so small as to be quite harmless locally. That I cannot tell, never having tried it.

6743. Can you tell the Committee anything with regard to benzoic acid; would you see any objection to its use as a preservative?—I have found it very irritating myself when swallowed.

6744. In what doses?—Five to ten grains—I have never taken more than ten. I took some when I was making those experiments on the acidity of the urine, and I found it exceedingly irritating to the stomach, but it never produced vomiting.

6745. On a full stomach, was this?—That was on an empty stomach.

6746. Five to ten grains, three times a day?—No, I took it in single doses always.

6747. Have you any experience of the harmful results on other persons to whom you have prescribed it?—No; it is frequently prescribed for septic conditions of the urine.

6748. Have you prescribed it much?—It is more prescribed by surgeons than physicians in those cases. I have frequently enough prescribed it, but I do not recollect ever to have seen local irritation of the stomach produced by it.

6749. Might we ask you to sum up your position with regard to preservatives both in relation to public health, and in relation to the profession?—I should say that their uncontrolled use is, of course, a thing to be deprecated, but that used in the quantities which are just required to prevent putrefaction, should think that they do very little harm, if any, and that the harm would probably be confined to some especially susceptible individuals, who are probably not numerous.

6750. Who are idiosyncratic, would you say?—Yes; and that the harm likely to result from food going at all bad from want of preservatives would probably be greater than the harm that would result occasionally from the use of preservatives in the quantity which is necessary to preserve food.

6751. (*Professor Thorpe.*) When you say food, do you mean milk alone or do you mean food in general?—I was thinking more of milk at this moment.

6752. It is important to be rather precise?—I should think that it could be extended probably to apply to all foods if it holds good of milk.

6753. (*Dr. Bulstrode.*) Do you think there is any objection to bringing a preservative, which undoubtedly either kills or checks the activity of certain micro-organisms, into contact with the gastric cells?—It depends entirely on the degree of concentration with which it is brought into contact with the gastric cells.

6754. You would say that 80 grains of boric acid in a pint of milk would be likely to affect prejudicially the gastric cells?—I should not like to give any opinion about that. I would feel uncomfortable if I were administering it, and I should not like to administer it, but I should not be surprised to hear that it produced surprisingly little results.

6755. Are you familiar with the experiments which have been made in connection with borax, with boracic acid, and with formalin?—I have read a summary of Leibreich's experiments.

6756. What do you regard those as tending to show?—As far as they went they showed that the local effect was surprisingly little, but his experiments were made purely on the lower animals. Rabbits, guinea pigs, and dogs, if I remember rightly.

6757. And adult dogs chiefly?—Yes. He has published a small book on the subject, I believe, but I have not read the original; I have only seen a summary of his results, and they went to show that he did not in any case find irritation of the stomach or intestine.

6758. Do you think that one can infer what may happen to quite sucking puppies from what may happen to adult dogs?—No, I think one has got to be very careful in making such an inference.

6759. (*Professor Thorpe.*) Do I gather that you see any particular disadvantage in the use of preservatives in milk?—That is not my position. It depends, as I said before, entirely on the amount of them used. I think that the use of a quantity of boracic acid or borax, or of a mixture of them just sufficient to preserve the milk, would probably be harmless in the immense majority of cases in any quantity in which milk is likely to be taken in the day up to four or five pints.

6760. If, however, it is pointed out to you that practically a well organised milk supply can be maintained all the year round without the use of such preservatives, and if it is further pointed out to you that the use of such preservatives tends to prevent the proper appliances being used in dairies, and to prevent the proper economical production of milk being brought about, would that modify your position?—Granted that it is possible to maintain the supply that you speak of—a perfectly pure supply—I think one would admit at once that that is the ideal to be aimed at.

6761. We have had it in evidence that a very large amount of the milk supplied to the best organised companies in this city is supplied all the year round, and is brought from very distant places, without the use of any preservative whatever?—Yes, but supposing the milk goes into the homes of the poor, and is kept standing for some time in a dirty room in hot weather, I should think it is exceedingly likely that, although it was perfectly pure when it was supplied, it would be beginning to go bad by the time it was consumed; whereas, had it con-

Dr. R. Hutchison.

7 May 1900.

tained a small amount of preservative, it would not be likely to go bad.

6762. May I point out to you that the difficulty in regard to the custody of milk is a difficulty which ought to be met by other conditions? There, again, by the maintenance of preservatives to check that kind of thing, you are tending to preserve a condition of things which ought to be altered. I suppose you will allow that milk ought not to be kept in these unsanitary conditions?—Yes; I will grant all that, but then your plan, I think, will be Utopian. You cannot educate the poor people. I should think, in this country. From my experience of dealing with hospital out-patient mothers, it is exceedingly difficult to make them keep milk under favourable conditions.

6763. That is as regards the domestic supply, but I am talking about the vending of milk?—That is just the point. It may be all right when it is sold, but then, if it is kept under bad conditions in the house all the good of keeping it up to that time will be done away with, and it will go bad, whereas had it contained a preservative it would not be so likely to go bad.

6764. People are not likely to keep milk over a long time in their houses now?—In the summer time twenty-four hours is quite long enough to make it go bad, and that is quite a common time to keep it.

6765. We have had it in evidence that milk can be kept, when it is properly treated to begin with, by cooling and by filtration, for longer periods than twenty-four hours without detriment to it?—If it is kept in a cool place and covered up?

6766. Even if it is kept under ordinary conditions?—Of course, that is for the bacteriologist to say. Looking at the matter, without having any bacteriological experiments to help one, and having regard to the conditions in which it is likely to be kept in ordinary life, I should say that you are running a risk.

6767. What I want to ask your attention to is this—if it can be shown to demonstration that the effect of legalising the use of preservatives would be to prevent the farmer taking due precautions in his cow-house, in the cleanliness of his cows, in the cleanliness of the hands of his milkers, in the proper scalding of his cans, and in all those things which are proper to the proper supply of milk—if I say it is pointed out to you that the effect of the use of boracic acid is to preserve wrong conditions in these matters—would that modify your opinion?—I should have thought that that difficulty could be met by a proper inspection of dairies.

6768. That is already partially met, so far as relates to a proper system of inspection of the places where milk is vended; we wish to supplement an adequate system of inspection of the dairies by adequate inspection of the places where the milk is produced?—If you want to educate the farmers, of course, then, it might be bad to encourage them to use preservatives; but if you want to preserve the public health, then I think you are looking at the thing from quite a different point of view, and it might be advisable, perhaps, to allow the moderate use of preservatives. It would take some time to educate your farmer, and meanwhile the public health might suffer.

6769. Is there any evidence that the public health suffered when these preservatives were not in use to a greater extent than it now suffers?—There is absolutely no statistical evidence worth anything, I should think; nor would it be possible to collect it on a point like that. But I am quite certain that the amount of harm done to children from milk which has turned sour, or which is beginning to turn sour, is very great indeed—I mean the amount of diarrhœa that is set up by it. I do think that the moderate use of preservatives might be expected to diminish such cases, by allowing the milk to be kept longer without going bad.

6770. I suppose that you are aware that we have had it in evidence—whatever the value of that evidence may be—that a considerable amount of infantile diarrhœa is associated with the use of boracised milk?—Yes. I believe that there is a certain amount of evidence to that effect, but, of course, I would not attribute that diarrhœa to the boracic acid necessarily.

6771. What would you attribute it to?—Probably there has not been enough of it added to keep the milk from going bad.

6772. But this is milk which is vendable, saleable milk, in which there is no suspicion on the part of the mother that it is sour?—Of course, the diarrhœa may be due to boracic acid. I am not saying it is not, but if you say that it is, you have got to exclude a vast number of other conditions. It is by no means all cases of diarrhœa in children that are due to bad milk.

6773. That is the point, but you rather led us to imply that a considerable amount of diarrhœa was due to milk which was on the point of turning sour?—There is a large proportion of diarrhœa that is due to sour milk, and there is a large proportion of diarrhœa that is not due to sour milk—that is, due to other conditions. That is all you can say.

6774. What precautions do hospitals take to ensure their getting a proper supply of milk?—They go to the good dairy companies.

6775. Do you mean as regards purity?—Yes. I believe in some hospitals they occasionally have an independent analysis made of the milk from time to time just to control it.

6776. Do they make any contract with the milkseller that he shall supply milk of a certain standard or quality?—As to that I really cannot tell you.

6777. Are you not connected with a hospiatl?—Yes.

6778. Which hospital are you connected with?—I am connected with the London Hospital, and with the Children's Hospital in Great Ormond Street; but the members of the staff do not necessarily know all these details about the providing for the catering of the hospital.

6779. You cannot say, then, of your own knowledge that in those two hospitals any precautions are taken in regard to the milk supply beyond dealing with reputable people?—I cannot say there is.

6780. Would there be any objection, for example, to entering into a contract with those milksellers in the same way that the milksellers themselves enter into a contract with the farmers?—There can be no objection at all, so far as I can see.

6781. (*Dr. Bulstrode.*) Having regard to the point we discussed as to the possible stultifying of medical treatment or modifying of medical treatment, would you advocate the course which Professor Thorpe has just suggested, of hospitals entering into a contract with their milk-supplying firms that no preservative should be added, or that if preservatives are added the nature and amount should be stated?—I think it would get over the difficulty you suggest, and would be quite a reasonable thing to do.

6782. With regard to infantile diarrhœa mortality, your thesis would rather point in the direction that, owing to the increased use of preservatives, infantile diarrhœa should now be decreasing?—Yes. I should think that one might expect that to happen.

6783. Do you know whether it is so or not—have you followed the growth and the variations of infantile diarrhœa together with the use of preservatives?—No, I have not.

Dr. G. F. Still.

Dr. George Frederic Still, called; and Examined.

6784. (*Professor Thorpe.*) You have heard the evidence of Dr. Hutchison?—Yes.

6785. Do you agree with it?—It is too lengthy to include it all in one. There are some points, I fancy, on which I should perhaps hold rather different views.

6786. Would you kindly tell the Committee in what respect you do not agree?—Our experience has been entirely different. I have been noticing the effects of borax and boric acid on children only, while his experience includes adults. I have nothing whatever to do with adults at any time; so our observations are on entirely different lines.

6787. Of course, in that respect your evidence would be the more valuable to us, because we are given to understand that it is primarily in the case of children that the hurtfulness, at all events, of the use of ordinary preservatives in milk is likely to be occasioned; would you kindly tell us the results of your observations on children?—They are only with regard to the use of boric acid and borax in milk. With 2½ grains of boric acid and 2½ grains of borax to the pint—where these were present together in one pint of milk—I, as far as my experience goes, should say that the milk usually produces no harmful results whatever, but it does now and then produce some looseness of the bowels; at any rate, its administration is

Dr. G. F. Still.

7 May 1900.

followed by some looseness of the bowels; whether this is due to the boric acid or whether it is a coincidence it is very difficult to say. I am quite sure one has seen cases where it produced a definitely good effect; in fact, in one case it was found necessary to add borax and boracic acid to the milk, because the child could not get on without it. The child was passing undigested stools, and was suffering severely from flatulence; he was put on borax and boracic acid in the milk, and became distinctly better; these drugs were then stopped, but it was found necessary to give them again, and the child did better with them than without. I consider, therefore, that boric acid is not always harmful. In infants, I have seen it produce, or, at least, followed by some looseness of the bowels; I have not seen any vomiting produced by it. In older children I have used it in the treatment of epilepsy, adopting the same quantities purposely of boric acid and borax, that is to say, 2½ grains of each in half an ounce or an ounce of water, given three times a day. This amounts to rather more than would be taken in the milk, for they would not have taken three pints of milk daily at that age. I am quite sure the borax has done good in epilepsy; I have used the ordinary bromide mixture alone first, and have obtained a certain improvement. This, however, has been only partial; borax has been added to the mixture, and then there has been a very definite further improvement, if one may judge by the parents' account. Dealing with out-patients one has to judge chiefly from these accounts, but, as a rule, parents do not give a more favourable report of their children's progress than they should, the tendency rather is to go the other way. They have been satisfied that the number of fits has been much less with the borax than with the bromide alone. I have no doubt it has done good. Boracic acid has then been added to the mixture, and seemed to have a further good effect in reducing the number of fits, but some of the cases have got looseness of the bowels, and one has had to stop the boric acid. I am, therefore, inclined to think that boric acid may produce looseness of the bowels, perhaps more often in infants than in older children, but occasionally in both of them.

6788. If these things have the specific effects that you allege, surely those effects should be under the control of a medical man, and they should not be left to the vagaries of a milk seller?—I was simply referring to the therapeutic questions that have been asked of previous witnesses. I was not dealing with the question whether these preservatives should be present in milk; I was directing myself to the physiological question.

6789. What is your point about that?—With regard to milk I should say most emphatically that no preservatives should be used if you can guarantee the milk being kept from decomposition otherwise. As far as I know there is only one dairy in London that at present partially succeeds in doing it. I know that the big dairies do not succeed; we have our milk supply at Great Ormond Street from Welford's, and this milk in summer, in spite of all precautions, is sometimes sour by the time it reaches the children; so presumably one of the best dairies in London is unable to supply at present, or does not supply, milk which does not decompose very shortly after it is supplied in the summer.

6790. Is that due to anything in the conditions under which it is kept in your hospital?—It is certainly kept under very much better conditions in our hospital than it is in the homes of the poor. I quite agree with Dr. Hutchison that at present it is absolutely impossible to hope to get the homes in such a condition that the milk shall not decompose. At our hospital the milk, when received, is placed in a large so-called steriliser, but we do not attempt sterilisation; it is supposed to be raised to 155 or 160 degrees; it is kept at this temperature for twenty minutes, and then it is drawn off into large cans which are at once covered up, and the milk is then delivered to each ward and kept in a cool place until it is used for the children. That is considerably more than is usually done in any private home, at any rate in the homes of the poorer classes; and yet, with all those precautions, we are very apt to get bad milk in the summer. I have seen one or two epidemics of diarrhœa there in the summer where it was traced definitely to the milk having gone bad before it reached the children.

6791. In what other points do you differ from Dr. Hutchison?—I do not know that it is exactly a point of difference, because I think that Dr. Hutchison would agree with me that if it were feasible to supply milk which contained no bacteria, or so small a number of bacteria as to be harmless, this would be vastly preferable to sterilising or pasteurising. My own experience of children has impressed me very strongly with the idea that a great many of the ailments of upper-class children particularly—infants, I mean—are due to sterilisation and even to the boiling of the milk. I believe that it has been greatly overdone. One sees infants who are not getting on, they are not gaining weight, their nutrition is suffering, without anything very evident to account for it, but if you take them off sterilised milk and put them on fresh milk, and see that the milk is not raised to boiling at all or is only kept at a pasteurising temperature for as long as ten minutes, these children rapidly improve. I believe for this reason that sterilising or pasteurising is not the best thing to be done. I believe the ideal thing would be to sterilise the udders of the cow and to sterilise the milkman's hands, and to restrict antiseptic precautions in dealing with the milk, as is done at present so far as is possible by the Walker Gordon Dairy. Their milk will certainly keep longer than most milk after being supplied; and, as far as I know, this is the only dairy in London that is even so far successful. But milk supplied in that way is altogether too expensive for ordinary use; it is quite beyond the means even of the middle class.

6792. What change comes over milk by sterilisation or pasteurisation which affects its nutritive value?—It is not known why scurvy rickets occurs in infants kept on sterilised milk.

6793. Rickets?—I would rather say infantile scurvy. Infantile scurvy certainly comes from the use of sterilised milk or milk that has been boiled a long time—not necessarily raised to a very high temperature. I believe that short of getting infantile scurvy infants suffer from conditions of mal-nutrition when they are fed continuously on milk which has been kept at a high temperature for even a short time, and that even prolonged pasteurising is harmful.

6794. What is infantile scurvy otherwise traceable to? It is not understood why milk which presumably has not been materially changed in its composition—it is the same food after the sterilisation as it was before—brings about scurvy?—The reason is unknown; but the fact remains clinically that it does. I believe it is absolutely unknown what is the one element the lack of which produces scurvy.

6795. Is it generally recognised in the medical profession that infantile scurvy is traceable to sterilised milk? —It is generally recognised that it is traceable to sterilised milk. Of that there is no question. It is a well-recognised fact.

6796. How was it produced when milk was not sterilised?—It can be produced by almost any of the patent foods.

6797. Is infantile scurvy a modern disease?—It has become more common in modern times—it is increasing. This, of course, is not in my own experience; it is simply a matter of other people's experience much older than I am, but this disease is said to be definitely on the increase.

6798. And you connect it with these patent foods and the sterilising of milk?—Yes. I believe that almost all infantile scurvy in the upper classes is due to sterilised milk and to these patent foods.

6799. (*Dr. Bulstrode.*) You have, then, certain objections against the use of both sterilised and pasteurised milk?—Yes.

6800. As a medical man?—Yes. I do not object to pasteurised milk so much as to sterilised milk. I think both would be very much better omitted, but the pasteurisation is far less harmful. The harmful results of sterilisation are much more than a matter of opinion; that has been confirmed by years of experience.

6801. We have had it in evidence before us that the milk supply of large towns—indeed, the milk supply throughout England—could be very well carried out if the procedure as regards sterilisation which you mentioned and also the application of cold and refrigerating were properly resorted to. Do you know any objection from your medical experience to reducing the temperature of the milk to freezing point?—No, I see no objection to it, but I think it is quite conceivable that it might produce scurvy at the other end of the scale. At present the view is that the scurvy is produced by the absence of some living element or other in the milk, and I suppose it is conceivable that freezing might have the same effect as boiling. But I have no experience, and I do not know that other people have, on the point, and I think it would be impossible to say at present. Otherwise, I think there is no objection to it.

Dr. G. F. Still.

7 May 1900.

6802. You think moderate cooling would not have that effect on it?—Certainly not, I should say.

6803. Is cream used much in children's hospitals at the present time?—Not very much; but I suppose it is used a great deal more there than in the adult hospitals. In Great Ormond Street we use it.

6804. Would you tell the Committee what you use cream for chiefly?—Cream is given usually for children who are suffering from marasmus where it is desired to increase the amount of fat in the food; it is not used specially for any particular disease that I know of; it is generally used for a child that is wasting.

6805. Do you see any objection to the use of preservatives in cream?—I think the same objections would apply there as in the milk. I think the possible irritating effect of preservatives is to be borne in mind, and I think also it is quite possible that there are chemical changes which might occur without their being appreciable by the nose or by the taste in cream kept by preservatives.

6806. You heard me discussing with Dr. Hutchison as to the manner in which possibly the indiscriminate use of preservatives might prejudice the position of a prescriber in a hospital or outside; would you give us your views as to that?—I am inclined to think that it might sometimes be serious, but there are so few drugs used as preservatives which are in common use for medical prescribing. Salicylic acid, of course, is important, and the benzoates.

6807. Salicylic acid, borax, and boracic acid?—Yes; but then, borax and boracic acid are comparatively seldom used; boracic acid, I suppose, very rarely, and borax not commonly. The benzoates and the salicylic acid, I should think, are the only common ones; formalin is practically never used internally.

6808. Salicylic acid is commonly used?—Yes.

6809. Do you see any objection to the indiscriminate use of that?—I think it would be distinctly objectionable, the physician would never know quite what does of the drug the patient was getting; it may be in the milk in any unknown quantity.

6810. Do you not think it is a very important matter for the medical profesion, quite outside the question of public health, to know whether their patients are already taking something of which they propose to prescribe relatively small doses?—I think so. If there is any there at all it should be accurately known what the quantity is, and it would be much better if there were none there.

6811. Do you think the milk supplied to all hospitals should be examined as to the presence or absence of preservatives?—Yes, I think it is most desirable, but it cannot be done at the hospitals in the ordinary way; there are many hospitals that could not manage it.

6812. It could be done outside by arrangement?—Yes.

6813. With regard to the milk which you obtained from Messrs. Welford, you say it frequently decomposes?—In summer, but not at other times.

6814. Do you know whether any preservatives have been added to it or not?—So far as Professor Thorpe's observations on our milk go, there has been none in the specimens supplied to him—fifteen specimens—I think I am right in saying that none of them contained a preservative. The butter has contained borax from 17·4 up to 47·6 grains to the lb. That butter has been used indiscriminately for the children—not all the children get it, but a certain number—and no bad effects have ever been traced to it.

6815. They would not consume much?—They would consume very little indeed, and only a few of them get it.

6816. Do you see any objection on general principles to the use of antiseptics in the stomach when they are not called for? You heard what I said to Dr. Hutchison as to the effect of preservatives on vegetable organisms—micro-organisms—assuming that the preservatives destroyed the life of these micro-organisms, do you see any danger to the gastric cells from them?—I really have no evidence to give upon that point; it is simply a matter of opinion. The only one that seems to me likely to do any harm is formalin, and I am very doubtful whether formalin may not do considerable harm.

6817. In what way?—By its action upon the stomach. I should think myself it would interfere with digestion if administered for a considerable time; I should think it would damage the cells and so interefere with the digestion. I have felt very chary in letting the children have anything that contained formalin.

6818. Do you think experiments in vitro would guide one at all as to what one might expect from the use of formalin in the human economy?—No.

6819. Not at all?—No.

6820. You would not attach much importance to those experiments?—No, I should not.

Dr. E. Hope.

Dr. E. Hope, called; and Examined.

6821. (*Professor Thorpe.*) You are Medical Officer of Health for Liverpool?—Yes. I have been five years Medical Officer of Health, and previous to that I was about ten years Deputy Medical Officer of Health.

6822. You have some opinions to offer to the Committee on the subject of the use of preservatives and colouring matters in food, I believe?—Yes. The Committee has been good enough to ask me to express my views on some of these points.

6823. Will you kindly tell us what you have to say?—I wish to say, in the first instance, that I am quite alive to the importance of preserving the food supplies, as far as they possibly can be preserved; and in view of the very large amount of waste which arises in the food trades, one welcomes any means that can be safely made use of to avoid waste of this description.

6824. In what sense do you use the word "preservative"?—I use the word in the sense in which this Committee is now dealing with the matter—in the sense of chemical preservatives, but associated with chemical preservatives is cold, and we find, as I shall presently be able to give you, evidence that chemicals are used as well as cold very frequently, so that the two means of preserving are associated in that way; cold alone, I think, receives its best illustration in the Copenhagen system, which, however, is perhaps not applicable in our country.

6825. Why is it not applicable?—I am afraid that ice is not so abundant, not so cheap, and I imagine that the inauguration of a system such as that at Copenhagen would involve a very large amount of capital, because there is nothing, so far as I know, in this country that at all approaches it or that has ever been run on those lines.

6826. Are you aware that an influential milk supply association in Manchester is beginning to run a supply on the Copenhagen system?—Yes, I am aware that there was, I think, two or three years ago, some system of that sort inaugurated, and efforts were made at or about the same time to employ the system in Liverpool. So far as Liverpool was concerned, it was absolutely without success; and, in regard to Manchester, I have no recent information as to the extent to which the system has been successful. I have no doubt at all that it has, to a limited extent, succeeded.

6827. You are doubtless aware that a considerable proportion of London is supplied with this milk, without the use of any other treatment than cooling?—Yes, I am quite aware of that; but what I meant by quoting the Copenhagen system was the system under which, from the very commencement until the distribution of the milk at the door, the milk was practically cooled and kept cooled below the point of putrefaction, or decomposition, solely by the means of block ice. That is really what impressed me so much when I was investigating the Copenhagen plan—the abundance and the constant use of ice.

6828. You are aware, of course, that the limited application of cold such as obtains in the case of a considerable amount of milk which comes, at all events into the better ends of this city, is sufficient to maintain the milk sweet during the time that it is necessary to keep it for the purpose of consumption?—Quite so. I am not adversely criticising that practice at all; I think that that is a remarkably good one. That system, more or less, I suppose, obtains throughout the whole country. If one takes Liverpool as an example, we find that the use of any chemical preservative is so rare as to lead one to conclude that it is not necessary at all with ordinary care and cleanliness; I am very strongly of that opinion.

6829 Then we may gather that you see no necessity

Dr. E. Hope.

7 May 190

at all for the use of the so-called chemical preservatives in the milk supply of a community?—I see absolutely none; and, in support of that view, I would quote the fact that the vast proportion of the milk sold in Liverpool is absolutely and entirely free from any chemical preservative. I think that fact is one which indicates that there is no necessity to put it in if due cleanliness and care are observed.

6830. Will you kindly tell us, before you pass on to the other subjects, whether you have anything more to say on the milk question?—I would say this, on the milk and cream question, that in those cases where preservatives have been added, there is a very grave risk of injury to the health of young infants who may be fed upon milk containing these preservatives, both in regard to milk and in regard to cream, because the chemical preservatives which will check putrefactive changes in milk or cream will also check the processes of digestion. You no doubt are aware that experiments have been tried by feeding young kittens upon milk containing different proportions of preservatives; these have been carried out extensively in Liverpool at the laboratories there, with the result that the kittens fed upon milk containing boric acid or formalin have died practically from starvation, whilst others equally healthy to start with, and fed upon ordinary milk, have grown and increased in weight, and remained in health.

6831. I suppose the great bulk of the milk that comes into Liverpool has no very considerable distance to travel?—About one-half of it has a considerable distance to travel; about one-half of the total supply in Liverpool comes from the country—Lancashire, Cheshire, and Shropshire.

6832. Two at least of those counties are near—of course, Liverpool is in one?—But still the milk comes from distant parts of the county; it does not all come from the immediate neighbourhood—in fact, I should think that most of it comes from some considerable distance.

6833. Not more than fifty miles, I presume?—Say about fifty miles.

6834. Have you anything more to tell us as regards milk or cream?—I should like to say that the use of preservatives in cream is very much more common indeed than it is in milk. Why it should be so I really do not know, but the fact remains. There is this peculiarity in connection with the use of preservatives in cream. It seems to have been going on for so long, and the practice has been, I will say, never found fault with—it has perhaps never been detected; consequently we find that the best makers or preparers of cream—I will not say makers of cream, but vendors of cream—send out their cream with those labels, some of which may be familiar to you—I have no doubt they are. (*Handing in pots of cream.*)

6835. Is this a character of cream which is mainly sold by grocers?—This is supposed to be a pure cream. This pot comes from Lord Vernon's dairy, and it has on it that it has a slight amount of preservative added to aid its keeping qualities. "This is necessary and usual," it states on it. It may be usual, but I do not consider it necessary.

6836. Is that a character of cream which mainly finds its way into the hands of grocers, or is it sold by dairy associations?—By both. The impression that one derives from reading that label is that because a thing has been going on for some years without its danger being demonstrated, therefore it may be legally continued. The same remark would exactly apply to milk. If the addition of preservatives to milk had not been promptly challenged, no doubt the preserving of milk in that way would still have gone on.

6837. It is stated on this label that the practice of adding the preservatives has been approved by the leading medical and scientific authorities; are you able to corroborate that statement?—No, I am not; I should be disposed to controvert that entirely. With regard again to milk, which is the most perishable of all articles of food, I take it, or as perishable as any other article of food, the sale of milk without preservatives shows that the preservative is not a necessity. It may be made out that the public want preservatives put in; it may be alleged that the public want them.

6838. By whom is that alleged?—By those who put it in—by the vendors.

6839. Is there any proof that the public desire to have preservatives in their food?—No; I say the proof is on the other side, from the fact that the public buy their milk without preservatives, and when preservatives were added complaints arose, followed by prosecutions, when the addition of the preservative was desisted from, and the sale of the genuine milk was resumed without any trouble or any difficulty. Therefore I contend that the use of preservatives in milk is an unnecessary thing.

6840. Now, with respect to the use of preservatives in other articles of food, what have you to tell us?—We find from the analysis of a variety of things that the use of preservatives appears to be becoming more and more extended and common in butter, ham, bacon, pork, fish, margarine, pork-pies, sausages, and so forth.

6841. Have you the same objection to the use of these articles that you have to their use in milk?—No, I have not so strong an objection. I do not think it is a desirable thing, but I have not the same objection that I have in the case of milk and cream, because these other articles are used by adults and people of stronger digestion, and the mischief may not be so accentuated in their case as it unquestionably is in the case of young infants. I should like, if I may, to revert to the milk point for one moment to quote just one domestic incident. A lady complained to me that she had made arrangements with her milk dealer to give him twice the amount he asked upon the condition that he should send her nothing but pure milk. At her own cost and charges she had the cows examined by a veterinary surgeon to see if they were all right; in fact, she wished to spare no expense to ensure pure milk for one of her infants. Things went on very well until one day the infant was taken violently ill. Nothing had been given it but under her own supervision. She at once went to the milkman and asked what he had been sending, and he admitted that he had put some boracic acid in the milk—he admitted it at once. I mention that as an instance—one of course not of many—in which mischief may be directly traceable to the use of a preservative in milk.

6842 What have you to tell us as regards the use of preservatives in other things?—In jam and in British wines what I wish to draw attention to is this, that even assuming that a minute quantity is necessary and harmless in those things, many of the manufacturers are exceedingly lax, more especially in regard to the quantity that they put in British wines. If it is admitted that 7 grains of salicylic acid to the gallon of British wine is necessary to preserve it, there is no reason why 150 grains to the gallon should be put in.

6843. Is that an actual case?—That is an actual case. That is what we find by our analyses; in one sample we find 7 grains to the gallon; in another one 150 grains, or even more than that. With regard to jam I have here an analysis of three samples of strawberry jam; one is entirely free from salicylic acid, the next one contains 0·28 of a grain to the pound, and the third one contains 1·75 grains to the pound; so that of those three one has none in it, the second has a small quantity, and the third has nearly ten times as much—and this is with precisely the same article. Therefore, even assuming that it is necessary—which I do not assume, because in one instance it is sold without any—but assuming that it is necessary to put some in, I take it that the minimum will meet all requirements; there is no need to put in a quantity which might be prejudicial, because jam is an article which is eaten by people of delicate digestion—young children, and so on.

6844. But your evidence would equally well go to show that the minimum required is zero?—Quite so, that is the position that I should maintain, that if an article can be sold, and is sold, and largely sold, without any, I fail to see where the need comes in for putting in a preservative. A sample of raspberry jam contained 4 grains to the pound—one could go on steadily increasing. It appears to me that if it be granted that some small quantity is necessary that the manufacturers are not careful to observe what is the minimum.

6845. They have no knowledge probably on the point?—Probably not.

6846. Have you exhausted all you have to say respecting the use of preservatives?—In certain prosecutions which have been brought about the defence has been that the quantity of preservative is not enough to endanger health. That is a moot point. We believe from experiments upon young animals that it is enough to endanger health. We cannot go on experimenting upon human beings in the same way that we can experiment upon kittens; we cannot employ means to feed young children only upon adulterated articles. We know that at the very commencement of the experiment the child would become ill, as in the case that I have just quoted to you, therefore we have no right at all to assume that the

Dr. E. Hope.

7 May 1900.

use of chemical preservatives is not attended with injury to the consumer. But that has been the defence, and an ingenious defence also has been put forward which no doubt has weighed with the Bench, namely, that these things are used in medicine, and larger doses are given in medicine than would be given here; but what one would point out is that to give a dose of physic under certain diseased conditions of the human body is one thing, and to administer drugs at odd times with every meal when they are not necessary is a most objectionable proceeding.

6847. Now, what have you to tell us about colouring matters?—With regard to the colouring matters sometimes, I presume, they are merely for ornamental purposes, and probably harmless, that is, in sweetstuffs and sausages. They are given to make the article attractive not to imitate anything else, but to give it a bright red colour, or for some such purpose in the case of foods of that description. A number of colouring matters I have got possession of, and caused analyses to be made of them. The commonest, which is usually used for sausages—German sausages especially—consists of borax, a red coal tar dye of the sulphonated diaso class, with salt or saltpetre, ground rice or bread crumbs. Then, Armenian bole is another common colouring matter.

6848. What does that consist of?—That consists of oxide of iron, with silicious matter. Then, the use of a material called "smokene" is not uncommon.

6849 What is the composition of that?—Smokene consists of borax, salt, creosote, and red coal tar dye. Whether or not that is used in such a manner as to cause injury to health is perhaps doubtful. The dye itself I am assured by chemists is an exceedingly objectionable one, but the use of it is to brush over hams and tongues and things which are usually smoked, and the consequence is that you see common unsmoked badly prepared articles of food with an appearance that one might see in a first-class purveyor's establishment, simulating the appearance of splendidly dried fish, tongues, and so on. Smokene undoubtedly has its uses and advantages, but the use of a colouring matter such as this I should say would border upon the fraudulent.

6850. You mean it would lead a consumer to suppose that the thing had been adequately cured by the ordinary operation of smoking?—Yes.

6851. Whereas it might have been imperfectly cured and covered over with this dye so as to simulate a proper appearance?—Yes, with this stuff which they call smokene. Another colouring matter, if it can be so regarded, really is or was an adulteration. The object of it is to change the colour and appearance of the article. I refer to the use of glucose, with common black treacle, to dilute down the dark colour and make it resemble golden syrup. That matter has been settled practically in Liverpool now by a prosecution. The persons prosecuted appealed to the Quarter Sessions against the conviction at the Police Court, but the conviction was upheld; so that the sale of a mixture of treacle and glucose for golden syrup is not likely to be continued. However, that is an instance in which there was the use of glucose actually as a colouring matter as well as an adulterant. Then the use of burnt sugar with dilute acetic acid to resemble vinegar may also be quoted as a use of colouring matter.

6852. In that case, although it is fraudulent, it is not directly injurious?—It is not directly injurious. One objection to the use of colouring matters is that they conceal the inferior quality; another objection is that they conceal staleness or dirt. For example, dirty rice, coloured with a yellow coal tar dye—the yellow colouring matter taking away the dirty appearance—is used to make what are called egg powders. Similarly the use of colouring matters with milk has come under our notice, the object of the dye being, of course, to make the milk a little richer in appearance.

6853. These egg powders are mainly of the character of baking powders, I presume?—Egg powders are baking powders, or are generally understood to be so. I should like to call your attention to one or two points in connection with baking powders. There is upon the market a powder which I will hand in, called "Egg Food," and it really is a preparation of a dried egg. I do not say that it is all that is claimed for it, but it is an albuminous food, and the chemical analysis of it is that it weighs 83½ grammes and contains about 14 grammes of albumen—about as much albumen as could be got from two eggs—and as much fat as could be got from half an egg. Therefore, that is an albuminous food, and could be used as an albuminous food, of course. But there is another powder upon the market called "Egg Powder," which is made up of tartrate of potash, bi-carbonate of soda, I suppose, and things of that description. Here are two others, both claiming to be complete substitutes for eggs (*handing in specimen packets*).

6854. Do you say that this which is labelled "Pegram's Egg Powder" is not really an egg powder?—It is not an egg powder at all, and it has no connection with eggs whatever—absolutely none. Cases have come to my knowledge in which poor and ignorant people have purchased these egg powders under the impression that they were a complete substitute for eggs, and with that idea they have actually fed their children on them. It is a most extraordinary thing, but that fact has come to my knowledge. One would hardly conceive it possible, but it is the case.

6855. I see on one of the samples which you have handed in the manufacturer distinctly states that it is not made from eggs?—Yes, that was sent to me by the manufacturer to know if it was a label which would be approved of—would it protect the vendor in selling the article? He marks it as "A complete substitute for eggs, but not made from eggs." Of course, we say, "No, it will not protect him." I brought that to show you.

6856. That has not been put on as a result of any prosecution, has it?—Yes, it has. They say: "What shall we put on? Will that suit you?" "No," we say, "it will not."

6857. May we gather that there has been a prosecution at Liverpool for selling this substance as being made from eggs?—Yes.

6858. And as a result of that prosecution the manufacturers propose to put on that label?—Yes. I should like to draw your attention to this fact—it is a trade question, and I do not wish to mention manufacturers' names, as there is no advantage in that.

6859. Before you pass on from that point, may we ask whether the other samples are like this? This one is called "Bird's Concentrated Egg Powder"?—That is the same as this.

6860. That also has nothing to do with eggs?—Absolutely nothing.

6861. Has that been the subject of a prosecution?—No.

6862. Is that sold in Liverpool?—Yes. I do not think that particular one has been the subject of prosecution. Others have; new ones crop up from time to time.

6863. That is not protected by any label?—No. That contains a yellowish colouring matter which I suppose is added with a view to forward the idea that there is some connection with eggs. I have an interesting correspondence bearing upon these colouring matters. The manufacturers are not the people whose names appear on these; the manufacturers make the article and it is sold by different firms—wholesale firms or other firms.

6864. Each puts his own label on?—Yes. When a prosecution was taken against these people their defence was rather curious. I will read a letter, if I may, from the manufacturers. It is a letter addressed to their solicitor who was defending them in the prosecution:—"Herewith a couple of these egg powder packets. The adulterant for these things and baking powders was alum." You see they considered that because they do not put alum in they may sell it under any designation they like.—"As there was no alum in these, we thought they would be all right. The labels were printed last year, before the new Act was passed. The firm in question are most respectable people, and have not the slightest idea of cheating anyone over it. They sold a great number of packets at Christmas, so it was evidently what was wanted." You see, that is one of the fallacies that those who use preservatives and colouring matters fall into. The public, not knowing what the things contain, buy the article, and the manufacturers then say there is a demand for it. The public will have it, and we must give it them. "People like ourselves, who are constantly making things like this up, get so in the habit of looking on egg powders, etc., as being mixtures, that it does not seem possible to us that anyone else will expect to get dried eggs, if there is such a thing." I do not see, if you say it is a substitute for eggs, why the same complaint may not still be made as on the summons—that it contains none of the nourishing properties. If it is a substitute it ought to substitute the qualities in respect to nourishment. That is a most extraordinary letter to come from a manufacturer. They are most respectable firms. It is merely an indication of the lack

Dr. E. Hope.

7 May 1900.

of knowledge of the people dealing with these things rather than of anything else.

6865. Still, it is not perhaps strictly relevant to the subject of preservatives; it is a case rather of the misdescription of an article, is it not?—At the same time, they do contain colouring matters.

6866. That is to help off the deception?—Yes. People associate yellowishness with eggs, and it is with that idea that a slight amount of yellow dye is put in.

6867. Have you anything more to tell us?—I should like to make a suggestion, if I may do so, in regard to the use of colouring matters and preservatives, namely, that whenever they are used, as, for example, in these cases, that the fact should be stated—a simple label should be put upon the article, first, stating the nature of the material used; secondly, the quantity of it; and, thirdly, the date on which the material was added. I can see no objections to such a course, but I can see every advantage, that the public would then know exactly what they are getting, how much of the article they are getting, and how long that preservative has been in the material. I do not know whether it would come within the scope of the enquiry to refer to articles which are sold as sterile and which are not sterile—not bacteriologically pure.

6868. But which contain preservatives?—Yes.

6869. Certainly?—Some do not contain preservatives, and are sold as sterile, but are not sterile; those, I presume we have no concern with here. But I take it that the sterility should not be owing to the presence of the preservatives. It should be owing to the cleanliness and carefulness of the method of preparation. If preservatives are allowed to be put in, you may still get a dirty and contaminated article, but a chemical preservative will be added which will keep it sterile.

6870. What class of things have you in your mind where substances are actually labelled sterile, which owe their presumed sterility to the presence of preservatives?—Milks are the articles that I have in my mind, and tinned milks.

6871. Are they distinctly labelled as sterile?—Sometimes they are; they claim to be, but by no means always. There are examples in which they claim to be sterile, but they are not sterilised.

6872. The word sterile to you I suppose connotes a thing having been treated at a relatively high temperature?—Yes, and as a result of that that it is bacteriologically pure, and has no organisms growing in it at all.

6873. It is of the essence of sterility that it should have been treated by the influence of a high temperature?—Yes, that the sterility should not be obtained by the addition of preservatives.

6874. By the addition of chemicals?—Yes.

6875. It would be a false trade description in fact to apply such a term to sterility produced in any other way than by the use of a temperature sufficient to make it bacteriologically pure?—It ought to be so. Then I wish to bring to the notice of the Commission the importance as a method of technical procedure in obtaining samples, that persons conversant with the business should be employed.

6876. You refer now to the inspectors?—Yes, now and again persons who are not familiar with the methods undertake examinations in an amateur fashion, and the consequence is that they may arrive at conclusions which are very misleading. It is a practical point—a point of administration; but an instance came under my notice in which a gentleman himself obtained and caused to be examined a number of samples of milk, and most of those samples were found to contain preservatives. So he at once jumped to the conclusion that he had got a fair sample of the article supplied to the public, and published his results. But inquiry showed that all of these things came from one and the same source—which illustrates what the Local Government Board, I believe, have already had under their notice—namely, the importance of having trained inspectors to obtain these samples in order to get fair average samples, and not a number out of one place.

6877. Do you mean to imply that it is not the custom of the local authority to employ competent men?—I do not wish to do more than emphasise the importance of obtaining trained assistants in this matter.

6878. What else have you to say?—Another matter that is of increasing interest by reason of the increasing trade is the use of borax in meat—pork more especially. This is not a use which I have any reason to think is objectionable at the present time, but the magnitude of it is a sufficient reason for bringing it before the Commission. Up till within the last two years very little fresh pork was imported from America into Liverpool, the reason being that the freezing process destroyed the appearance of the pork, and made it unsightly, and there was very little, if any, sale for it. Now, instead of freezing it to such a low temperature as to make it unsightly, the pork is kept in a temperature of about 33 or 34 degrees, or a little higher than that—chilled, as they call it; sometimes I know it is lower than that. The object is to chill it. In order to prevent any decomposition, the pork, which is packed in cases about 50lbs. weight, is sprinkled over with borax or dipped into solutions of it—usually the powdered borax is sprinkled over it; it is then put into the cooling chamber, and is brought over. But the trade is a very large one. Last year it appears that something like 36,000 carcases of pigs were brought over to Liverpool alone from America treated in this way, but up to within the last year or two there was none brought at all; so you see there is a rapid development of a new industry, and, so far as I am able to ascertain, there is no objection to the practice. I think there is a vast distinction to be drawn between the use of a preservative in that way and the use of a preservative in milk, or in cream, or in any other way.

6879. Have you anything more to add to what you have already told us?—There is just one more fact I wish to call the attention of the Committee to—that is, that the Corporation of Liverpool, amongst other Corporations, are establishing depôts for the sale and distribution of milk specially prepared for young infants. The milk is humanised and prepared in a way that I need not detail, and is distributed in such a way that the child shall get a pure humanised milk. What I wish to point out in regard to that is, that the Liverpool Corporation and the other Corporations and private dealers who are following on the same lines must get their milk from wholesale dealers. Now, if the wholesale dealers before sending the milk to their customers put a preservative into it, and that milk with a preservative in it is prepared for young infants, the presence of that preservative will do the most serious mischief. You may say that every sample should be examined and analysed, and so on; that may or may not be practicable; but there is no doubt whatever that if a chemical preservative is put into milk which is destined for young infants very serious mischief will result.

6880. As regards your Corporation, however, they could take steps to protect themselves against the use of preservatives?—Quite so; we should always endeavour to protect ourselves against foreign constituents in the milk that we get; but we wish not only to protect ourselves in that way, but to protect ourselves now by emphasising the danger which will result if milk dealers are permitted or countenanced to put a preservative of this kind into the milk. It may be that the best of means may sometimes fail in the way of detecting preservatives in milk; it may be that samples are not always examined; there are a hundred things that may occur, and so we wish also to safeguard ourselves at the very source.

6881. When you say these are got from wholesale dealers, I presume you mean dairymen who stand between you and the farmers?—Either that or the farmers themselves; we may get it direct from the farmers, or we may get it from the wholesale dealers who stand, as you say, between us and the farmers.

6882. As a rule the wholesale dealers enter into contracts with the farmers?—Yes.

6883. And the contract specifies, as a rule, a certain limiting value of butter fat, and frequently that the content of non-fatty solids shall be not below a certain amount; it stipulates further that it shall be the whole milk of the cow, and that it shall not contain preservatives?—Sometimes those clauses are added, but not always. In our contract for our city hospitals, for example, we ask for "pure new milk"—I think that is what we ask for—and then we have a clause relating to the tuberculin test, but that is foreign to the point. We assume that in asking for pure and fresh milk we get pure and fresh milk.

6884. What steps in your hospital do you take to assure yourselves that you do get pure and fresh milk?—Very frequent analyses, but we cannot analyse every canful of milk that arrives—that would be an impossibility.

6885. Those analyses, I presume, would be entrusted to Mr. Collingwood Williams, would they not?—Yes, and Professor Campbell Brown.

Dr. E. Hope.

7 May 1900.

6886. Would they report the presence of preservatives?—Yes, they report the analysis of every sample taken and every detail.

6887. Including the preservatives, if present, and the amount?—The amount and the nature of it.

6888. I presume they would also report any deficiency in the normal constituents of milk?—Yes, they give us complete analyses. What I was emphasising is that there may come supplies of which we do not get a sample. We do not take one every day. What we want to object to is having preservatives put in at all.

6889. (*Dr. Bulstrode.*) In relation to the Liverpool Fever Hospital, are precautions taken there against the use of milk containing preservatives?—Yes, those precautions which I have just mentioned—by taking frequent samples on delivery. Samples are taken by inspectors under the Food and Drugs Act on delivery at the hospitals.

6890. At the fever hospitals?—Yes.

6891. Do you regard it as a matter of importance that milk containing chemical preservatives should not be supplied to a fever hospital?—Yes.

6892. For what reason?—Simply because we believe that these chemicals interfere with the digestive processes, and in the case of sick people, people with typhoid fever, and so on, we wish them to have nothing but natural food.

6893. Would you see any danger in prescribing milk with a large quantity of boric acid for cases of scarlet fever and kidney disease?—Yes, I should object to the administration of any drugs of any kind or description to patients except under the guidance of the physician.

6894. Do you think the physician himself ought to know whether the drug which he is prescribing is already contained in large quantities in the food which the patient is taking?—Yes, I certainly think he should know exactly what is the composition of the milk which is given to the patient.

6895. Do you think there is a danger at the present time of the prescriber rather stultifying himself?—Yes.

6896. Your experience, I take it, goes to show that a population of getting on towards three-quarters of a million can be supplied quite well with milk without the use of preservatives?—Yes, that is the fact.

6897. And also without the use of refrigerating?—Yes, that is so.

6898. Therefore ice would not be necessary; so, supposing the use of preservatives were prohibited in milk, that would not involve any costly machinery for the production or the storage of ice?—I do not know that it would, but I should like to say this: that the supply of milk in the city of Liverpool, and the milk trade generally, is improving. It is now well in the forefront; it is keeping pace with the times. I have no doubt whatever that if additional machinery were necessary it would be provided by the dealers.

6899. If you had to choose between sterilisation and chemical preservatives in a limited degree, which would you select for milk?—Sterilisation without question.

6900. We have been told this morning, just before you came into the room, that infantile scurvy was increasing considerably, and that in the opinion of the medical profession that increase is due in large part to the use of sterilised milk?—I have never heard that before.

6901. You never heard that opinion before?—Never.

6902. It was attributed to the use of sterilised milk and prepared food generally?—I can quite imagine that mischief may result from artificial foods the composition of which is doubtful, but I have never heard any such thing raised in regard to the use of sterilised milk or humanised milk; in fact, there is strong evidence to the contrary from St. Helens if you wish that, where they have already established a sterilised, humanised milk depôt with very satisfactory results—so satisfactory that the Corporation of Liverpool are imitating it.

6903. Would you have been in a position to ascertain whether the use of that sterilised milk was giving rise to any bad results among children?—I have personally made the inquiries. I have been over to St. Helens more than once, and have had frequent interviews there and in my own office with the Medical Officer of St. Helens, and his results are entirely favourable.

6904. To what extent, do you know, is sterilised milk being used in St. Helens?—I believe in the summer time they were supplying about 100 families a day—I do not think more than that; but they were supplying it in the most careful manner, every record being kept of the progress of the case. It was not simply sold as an ordinary dairyman would sell milk over the counter, but the children were recorded, their weights were taken, and their progress noted.

6905. And no bad results have so far been observed?—None that I have been able to ascertain or have heard of, or even heard hinted at.

6906. How long has this experiment been going on for?—Since last year.

6907. Continuously?—I should think for about twelve months now.

6908. You would rather expect that if any great harm is likely to occur from the use of chemical preservatives we should have cases on record where we might have had outbreaks of baracic acid disturbance, or salicylic acid disturbance, or something of that kind?—The difficulty is this, that the symptoms of baracic acid disturbance would so closely simulate those of ordinary aggravated indigestion that I should hardly expect that definite notice would have been called to it, more especially with young children—their ailments are so difficult to trace very often.

6909. You do not think it might have been observed in connection with some individual milk round on a certain occasion when, owing to carelessness or what not, an undue amount of preservatives was added?—That would involve the co-operation and careful attention of the mothers, and I doubt if there are many who are feeding their children in precisely the same way as in the case that I quoted, in which clearly the mischief there was traceable to the preservative.

6910. In that case was the preservative added on the one day in which the child was supposed to have been ill?—Yes.

6911. On only one occasion?—It at once attracted the attention of the mother, an extremely careful and very intelligent woman, who forthwith went to the milkman to ask him straight.

6912. And he said that he had supplied them with non-boracised milk up to when?—Up to that very day.

6913. Have you had any experience of the use of sulphite of sodium as a preservative in meat?—We have had some; I have heard of the use of it.

6914. It is used in America a good deal?—I have not made definite inquiry into it.

6915. Do you know anything of the preservatives in fish; have you had any experience as to that?—Fish was at one time experimentally preserved some years ago, I remember well, with boracic acid, but it was given up.

6916. Why?—Because it destroyed the flavour of the fish. Certain members of the fish trade were interested in it at the time. It was thought to be a new thing which was going to preserve fish better than salt, and it interested me too. I tried the fish preserved in this way several times, but it was not good. If I remember rightly it quite destroyed the flavour. I am not aware that the extensive use of that preservative has been returned to.

6917. Have you heard of the preservation of fish by formalin?—Yes.

6918. Do you know if that is carried on at all?—That I have no definite information about.

6919. Have you ever heard of the use of boracic acid for keeping oysters fresh?—No.

6920. There is a case which I have been reading in an American Committee's report where thirty-eight grains of boracic acid were found in a pound of oysters; would you see any objection to that as prescribed to invalids?—Those, of course, were tinned oysters, I presume?

6921. No; I think it was simply added to keep the oysters apparently fresh?—I should object to that most strongly. I should be very sorry to eat the oysters.

6922. As regards the behaviour of infantile diarrhœa in Liverpool, is there nothing which you can give us any information upon from the point of view of the preservatives used?—I am afraid not. There is no doubt about this, that the infantile diarrhœa which is so prevalent and fatal in Liverpool is owing to the use of feeding bottles containing putrefactive and putrefying matter. I do not think that any remedy could be looked for in adding preservatives to the milk which is put into those feeding bottles. Simply you would be just where you were. You would get the boracic acid doing the mischief that the organisms are doing—possibly in a different way, but the results of experimental investigation upon animals leads one to conclude it would be exactly the same.

6923. In reference to salicylic acid, I gather that as much as 150 grains of salicylic acid have been found in a gallon of wine?—Yes.

6924. That is about nineteen grains to the pint?—Yes.

6925. Do you regard that as a danger to the public health?—I think it would be one of the things which would upset the children to whom that stuff is given at children's parties and so on.

6926. What wines are you more particularly speaking of here?—Orange wine; what they call British wines, made from fruits of different kinds.

6927. How much of this sort of wine do you think would be consumed by an individual in a day or at a sitting?—Very little.

6928. So you would hardly think that a very serious matter in these instances?—I do not think it is a serious matter, but I think it is objectionable and unnecessary. One finds a very much smaller amount in some than in other samples of the same thing, and one can see no reason why such a lot should be put in. Black currant wine is another of the British wines.

6929. Have you any evidence as regards the use of copper as a colouring matter that you would like to state to the Committee?—Copper is not an uncommon thing in peas, and in the bottled fruits that one sees—beans and so on, fresh, green-looking things. There the question again comes to be one of quantity to a very great extent. Our prosecutions for the use of that colouring matter, copper, have been undertaken where the quantities seemed according even to the evidence of the trade to be excessive and unnecessary—$2\frac{1}{2}$ grains to a pound, say. The trade do bring forward evidence to show that a small quantity, half a grain to a pound, is necessary to give a fresh colour to the peas. We have not undertaken prosecutions where so small an amount as that has been present.

6930. Do you think it is established that copper in the form in which it exists in peas is soluble in the human economy?—I think it is.

6931. Would you mention the experiments you would base that conclusion upon?—I base it upon what has been told me, what I have been informed by persons who have taken these peas. One very eminent professor of chemistry has expressed himself very definitely upon his own personal feelings in the matter.

6932. Did he have symptoms of copper poisoning?—He had great uneasiness and indigestion resulting from the use of coppered peas.

Dr. E. H. Starling, called; and Examined.

Dr. E. H. Starling.

6933. (*Professor Thorpe.*) You are a Fellow of the Royal College of Physicians and a Fellow of the Royal Society?—Yes.

6934. You have been deputed to attend here on behalf of the College of Surgeons to give evidence at this inquiry?—Yes.

6935. What have you to say of your own personal knowledge as to the behaviour of the various preservatives; in the first place you had better tell us what are the preservatives which in your opinion are most constantly employed?—On that point I have no experience whatever, and I have no special knowledge.

6936. You do not know what preservatives are actually used?—Only from hearsay.

6937. What are you led to believe they are?—Formalin, salicylic acid, boracic acid, and borax.

6938. Have you made any experiments as to the behaviour of those things?—I have made certain experiments with regard to the action of formalin, not especially with regard to this practical point, but in the laboratory I have made experiments from a physiological point of view on the action of formalin and the action of salicylic acid on the digestive juices and their digestive power on foods.

6939. Will you kindly state the result of your observations?—With regard, in the first place, to formalin, I have found that proteid substances, that is to say, meat substances and fibrin, treated with only very small quantities of formalin—1 in 1,000—become practically indigestible. A shred of fibrin which would be digested by the action of the gastric juice in five or ten minutes is intact, or practically intact, after two days. This action of formalin on fibrin is not removed by continued washing with water. I have washed it in running water for two or three days, and the fibrin still remains indigestible. In the same way I have experimented, using formalin to prevent decomposition in the artificial pancreatic juice, the other chief digestive juice of the body. There, of course, it prevents decomposition extremely satisfactorily, but it absolutely stops all digestion; so that I should say the use of formalin prevents any foods, at any rate, of the nature of proteids—that is to say, meat foods—from being digested, and takes away their food character altogether.

6940. For that reason do you think its use in food supplies ought to be prohibited?—Formalin certainly should be absolutely prohibited.

6941. What have you to tell us as regards salicylic acid?—Salicylic acid is certainly less harmful. In an acid medium, that is to say, the medium in which the stomach digestion goes on, it acts as an antiseptic, but in the stomach where it is acting as an antiseptic it also prevents the action of the gastric juice, and stops digestion in the stomach. Clinically, of course, one knows that the use of salicylic acid, especially in the free state, is apt to cause symptoms of gastric dyspepsia, pain in the stomach, and stoppage of gastric digestion. In an alkaline medium it apparently is not an antiseptic at all—that is to say, when the food gets down to the intestines where the medium is alkaline, and where it is attacked by the pancreatic juice, it does not disturb the digestion, and there, of course, it is not acting as an antiseptic.

6942. Then what is your view as to the legalisation or otherwise of salicylic acid?—Salicylic acid is a drug, and a fairly potent drug, extremely potent in certain individuals; I do not think it ought to be given except as a medical remedy. I certainly do not think it ought to be used unknown in food stuffs.

6943. Would you allow its use, therefore, if it was indicated that it was present?—For myself I should feel inclined to forbid its use entirely.

6944. Now turning to boracic acid and borax, what have you to tell us?—There one has certainly the least harmful of those three antiseptics. Experiments on animals have led to very little results, that is to say, with very large doses of borax given with the food vomiting is produced, but with ordinary doses of boracic acid and small doses of borax—such as is generally contained in food kept sweet by them—dogs, for instance, take the food and are apparently unaffected by it—all their processes are unaffected by it, they put on fat and so on. Of course, borax and boracic acid are absolutely foreign to the animal body, and its innocuous character seems to be due to the fact that it is rapidly eliminated from the body and passes off through the kidneys. So that from the point of view of an experiment carried out on a healthy animal during a few days or a few weeks one cannot say much against boracic acid or borax. Of course, on the medical evidence (of which my knowledge is only second-hand or dates from some years back when I had to do with cases), I should object to the use of boracic acid and borax from its action, especially in milk. Medical literature is full of cases of dyspepsia and cases of dryness of the skin, dryness of the mouth and certain skin affections which are said to be produced by boracic acid, or by the use of borax. Of course, in many of those cases the presence of borax or boracic acid was rather assumed than proved by chemical investigation. Much of this evidence is mere hearsay evidence, but I think there is so much of it, that there is probably some truth in it. I have known of one or two cases in which the milk was analysed and in which symptoms of dyspepsia in an infant were certainly due to the presence of boracic acid in the milk.

6945. Is infantile scurvy ever likely to be produced by boracic acid or borax?—That term scurvy is very largely a question of malnutrition. It might be produced by the presence of borax just as by the taking of infected milk.

6946. Do you think infantile scurvy is likely to be produced by the use of sterilised milk, sterilised in the ordinary way?—I think it is extremely unlikely. There are one or two medical men who have laid a good deal of stress on the production of scurvy by sterilised milk. They say that boiling the milk or heating it destroys some mystic property that it has, something connected with its living characters or something of that sort, or perhaps some ferment which is essential to the life of the young animal. There is no doubt that there are certain minute properties in milk—anti-toxic properties—which are derived from the mother, and which are an inherited gain

Dr. E. H. Starling.

7 May 1900.

for the infant, but which are not absolutely necessary for the infant. I think an occurrence of scurvy, that is to say, of malnutrition, as the result of sterilised milk is extremely unlikely, and at any rate it is extremely uncommon. The number of houses in which children take nothing but sterilised milk during the whole of their younger existence is very large indeed, and I have never come across a case of infantile scurvy which could be said to be produced by sterilised milk. The anti-toxic properties of cows' milk would probably be of no advantage to the human infant, and their destruction by boiling would be therefore a matter of no importance.

6947. Is infantile scurvy more prevalent in certain sections of society than in others?—That again is a statement that has been made.

6948. In what particular section is it most prevalent?—In the higher classes.

6949. It would be the higher classes that would probably use sterilised milk to a greater extent?—Yes.

6950. And the two things have been connected together as cause and effect?—Yes.

6951. Is that the only connection which has been traced?—That is all, I think.

6952. Is it upon that supposed connection that the inference is drawn?—I think so; simply that the children were fed on sterilised milk and that they got scurvy, and therefore since there was no infection it must be due to the sterilised milk.

6953. But no direct experiments have been made to show that?—No direct experiments at all.

6954. What is your view as to the legalising or otherwise of boracic acid and borax in milk; would you tolerate its use?—I should not tolerate its use.

6955. If it can be shown to you that it would be perfectly possible to carry on a milk supply without the use of preservatives, you see no reason why they should be allowed?—No, I certainly think they ought to be forbidden. Supposing its use is allowed, one might be taking borax, this foreign constituent, the whole of our lives, and excreting it through our kidney cells, and I should think it extremely unlikely that the kidneys could go on excreting this foreign substance for years without suffering from it. It is a foreign substance which affects life, which affects protoplasm, to which the antiseptic action is due, and I should think it is extremely unlikely one could go on taking it for years without suffering from it.

6956. Do you think, as regards children, it is an unnatural labour to throw upon the kidneys to expect them to excrete this substance?—As regards children the ill effect is shown earlier in the alimentary canal. The child's stomach cannot stand the presence of borax and boracic acid, and so we get the symptoms of vomiting and diarrhœa which are at once checked by changing the milk. In some cases I have known improvement follow getting milk from a farm near at hand instead of getting boracised milk from a distance.

6957. (*Dr. Bulstrode.*) With regard to formalin, are you familiar with the experiments of Drs. Rideal and Foulerton?—Is that with regard to the administration of formalin.

6958. With regard to the effect of formalin upon the animal tissues, and with regard to its effect upon nutrition?—I do not know that. I am not familiar with those experiments. I have seen some experiments in which formalin was given without very ill results.

6959. But you are not familiar with that paper?—No, I do not think I am; I do not remember reading it.

6960. Your conclusions as regards the effects of formalin are drawn from your own experiments alone?—From my own experiments.

6961. Have you published those experiments?—No, I have not published them. I was not dealing with the effect of formalin, I wanted to use formalin as an antiseptic. It would be a great convenience to me to be able to use formalin as a preservative for various kinds of foods.

6962. You were using it in the strength of one in 2,000?—Yes.

6963. Have you tried any experiments with much weaker proportions than that?—I have tried it in the proportion of 1 in 10,000 to preserve material, and I have tried it in the proportion of 1 in 5,000 to keep the pancreatic digest sweet, but I found the proportion of 1 in 5,000 stop the action of the pancreatic juice.

6964. What do you find with 1 in 10,000?—I have not tried the effect of that on digestion, so I could not say; I merely found it was a sufficient antiseptic in that stage.

6965 Would you contemplate any damage to the kidneys from the use of formalin as a preservative—even dilute formalin?—Formalin has been employed as a remedial reagent in phthisis by inhalation when considerable amounts have been taken in, and so far as I know no ill-effects have been observed except the disturbance of digestion.

6966. Your objection to it would be based upon the results of your experiments and its effect upon proteid matters?—Its effect upon proteid and its effects upon the digestive activity.

6967. Do you think this question of preservatives is an important one for the medical profession from the point of view of the administration of drugs?—In certain cases, yes. In the case of salicylic acid, for instance, I should think it is very important to know whether salicylic acid has been taken by the patient or not.

6968. For what reason; would you tell the Committee that?—Because salicylic acid has a definite action; it is given in large doses in rheumatism—at any rate, it is given in as large doses as the patient can stand; and we might be giving a patient too large a dose, producing sometimes a poisoning effect, when one thought one was only giving a small dose. If we give too large a dose—and the definition of that "too large" a dose varies with the individual very largely—one may produce first buzzing in the ears, then deafness, then insanity, or, rather, temporary mania—a very serious condition in which in some cases patients have committed suicide; of course, it only lasts a short time. Therefore, it would be very important to know that one was starting, so to speak, from the base line, and not in front of the base line.

6969. Are you speaking of the results of recent experience with salicylate of soda?—Yes.

6970. Is the production of delirium as common as it used to be when rather impure salicylates of soda were used?—From my own experience I am not fit to give you an opinion on that; opinions seem to vary on that point.

6971. Would you tell the Committee under what morbid conditions you think the administration of salicylic acid or salicylate of soda would be contra-indicated?—Certainly in any case where there is any cardiac weakness or any reason to anticipate cardiac failure.

6971* In those cases you would prescribe salicylic acid with great caution?—Yes.

6972. Therefore you would be averse to its indiscriminate use in the foods of the people?—Most certainly.

6973. Can you say under what conditions you think boracic acid is contra-indicated?—There, again, if there was any lesion or disease of intestinal tract—in typhoid, for instance—I should think it would be extremely dangerous.

6974. Do you think it would be dangerous to feed a typhoid fever patient upon milk containing 20 grains of boracic acid to the pint?—I would much rather feed him on beef steaks; I should think it would be very dangerous to feed him on that.

6975. (*Professor Thorpe.*) Are not large quantities of milk taken by such patients?—Three pints a day is the normal amount, and in other cases of febrile disorder, cases of diphtheria and so on, one might take as much as six or seven pints a day—we administer as much milk as the patient can take.

6976. In such cases the use of boracised milk might be injurious?—It would give rise to vomiting, and might ruin the case altogether.

6977. (*Dr. Bulstrode.*) Do you know anything as to the cumulative effect of boracic acid in cases where the kidneys are diseased?—No, I know nothing about it. All I know is that in healthy cases there does not seem to be a cumulative effect.

6978. Would you prescribe it in cases where you know the kidneys were diseased?—So far as I know boracic acid is not prescribed in any case except externally as an external application, and there I do not think the presence of kidney disease has been looked upon as a contra-indication.

6979. Do you know anything as to the use of sodium sulphite; do you think that would be a safe preservative to use?—Here I am not talking with much authority, but I should say that sodium sulphite would probably have very little ill-effect except as an irritant; in that case it would be in some way comparable to borax.

Dr. E. H. Starling.

7 May 1900.

6980. What dose of sodium sulphite is used in medical practice, do you know?—I cannot say; I have never prescribed it.

6981. Can you tell the Committee anything with regard to the solubility of copper in peas?—The condition in which it exists, do you mean?

6982. Whether it is soluble when taken into the human system in the condition in which it exists in peas?—There I can only argue *a priori*, as I have no definite facts to go upon. I may say that copper sulphate will probably enter into combination with the proteid constituents, and that would be soluble either in dilute acid or in a dilute alkaline solution, and therefore would be absorbable. Experiments have been made with these copper albumenoids in animals, and sometimes a poisoning effect has been produced. On the other hand, of course, the action of copper is very largely on the intestines, and therefore one does not need absorption of the copper to take place.

6983. Would you be opposed to the use of small amounts of copper for colouring matter in peas?—Yes, I should, most certainly.

6984. Quite small amounts of sulphate of copper, say a grain to a pound?—Copper in a dilution of one in two millions has an appreciable effect upon living things; it is one of those substances which has a very appreciable action in very minute doses, and therefore I should think it was very dangerous, at any rate if one constantly takes in, say, half a grain to a pound of peas.

6985. Constantly?—Yes; of course, one small dose one can survive.

6986. Upon general principles, would you see any objection to the use of an antiseptic in food which inhibits the growth of micro-organisms; do you think that would affect the secreting cells of the economy?—Yes; on general principles I should say it was highly unwise to employ any antiseptic in food, because after all there is the living stuff, the protoplasm, of the micro-organisms that cause putrefaction, and the protoplasm of our body are one and the same thing, and these general antiseptics that one gets are poisons for the whole—they are poisons for the one living material just as they are poisons for the other. One may get variations in degree which one may make use of in treatment. Thus one can get a poison which will poison some form of living organism, such as the malaria organism, more quickly than it will poison the human organism.

6987. Do you think the difference of degree might be made use of in regard to preservatives?—It would be very dangerous to make use of that, because one is always apt to get a cumulative effect; one would be having the small effect of the dose on the human organism, though one had the total destruction of a microbe which might have infected the food, but this small dose would cumulate, it would be a constant factor tending to diminish the vitality of the body.

6988. Are experiments with artificial gastric juice reliable as regards what may take place in the body?—They are reliable, but they are probably harder, so to speak, on the drug used, on the antiseptic, than experiments on the living.

6989. Harder on the drug?—Yes, because in the living animal one has organisms of defence; supposing one gives a drug into the stomach of the living animal, the stomach so far as it can removes the deleterious material so that it can proceed on its way with the digestion of the food.

6990. You would eliminate the effect of the preservative upon the gastric cells altogether, would you not?—In artificial experiments, yes.

6991. Which with regard to formalin would be an important one from your point of view?—It would be an important one.

TWENTY-FIFTH DAY.

Tuesday, 8th May, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, Bart., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
F. W. TUNNICLIFFE, Esq., M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Mr. CARL W. SORENSEN, called; and Examined.

Mr. C. W. Sorensen.

8 May 1900.

6992. (*Professor Thorpe.*) You are consulting expert to the Manchester Pure Milk Supply Company, Limited, I understand?—Yes.

6993. And you were formerly chief dairy expert to the New Zealand Government?—Yes.

6994. Over what length of time did your New Zealand experience extend?—Seven years in all, three and a half years of which I spent as manufacturer and shipper of dairy produce on my own account, and three and a half years with the New Zealand Government.

6995. Your first knowledge of preservatives I believe was when you used them experimentally on the advice of your London agents in a few tons of butter?—Yes, that is so.

6996. What was your experience in regard to that experiment?—My experience was that nothing was gained from a commercial point of view. Theoretically it was claimed that there was some slight gain, but it did not affect the price of the butter in any way. I got not a penny more for the butter treated with preservatives than I did for that without.

6997. When you say that theoretically it was claimed that something was gained, what do you mean by that?—I mean that the agents reported that one or two boxes were particularly fine, but they could not get any more money than for the average.

6998. Would that assume that there was a distinct improvement in those particular cases owing to the use of preservatives?—No, I think not.

6999. As the result of that experiment, however, you did not think fit to continue the use of them?—No, I saw nothing to be gained by it, and as the use of preservatives entailed a considerable expense I gave it up.

7000. Were your London agents satisfied?—Quite.

7001. When you became appointed as chief government expert you found, I understand, that opinion was divided as to the value of the use of preservatives?—Yes.

7002. Would you kindly state to us what you observed?—I observed the fact that large factories were using preservatives and claiming that they got considerable benefit, whereas others equally large were not using them, and found their results quite as satisfactory. I accordingly instituted a series of inquiries amongst the factories, sending out circulars with a list of questions to be answered by owners and managers. The verdict was that 60 per cent. found the preservatives unnecessary or useless, 20 per cent. were undecided or declined to express any opinion, while the remaining 20 per cent. were in favour of their moderate use.

7003. Were the 20 per cent. who were in favour of their moderate use large or small exporters?—Some of them were very large; indeed some of them were the largest exporters in the colony.

7004. Those people found it desirable to use them?—

Mr. C. W. Sorensen.

8 May 1900.

Yes—to a very small extent, however—to the extent of one quarter per cent.

7005. They resolved themselves into not more than about that?—One-fourth to one-half at the very outside.

7006. Are we to assume then that the greater portion of the butter which comes over to this country from New Zealand contains preservatives?—At the time when I left New Zealand I could safely say that two-thirds of the butter was not treated with preservatives.

7007. Two-thirds of the butter which reached these shores was not treated with preservatives?—Yes.

7008. How does the matter stand now?—I am not able to express any opinion as to how it stands now.

7009. Do you imagine that the use of preservatives is gaining further favour?—I have some further reason to think that there has been an increase in their use since I left.

7010. How do you imagine that increase has been brought about? Has pressure been brought to bear upon them; if so, from whom—from here or how?—In one or two cases it has, but not so much so perhaps as formerly. I can remember about five years ago when certain London firms importing butter from New Zealand stipulated that the butter should be treated with a certain percentage of boracic acid or other preservatives, but on the other hand these preservatives had to be obtained from these particular firms or their agents. Lately I think that custom has rather died out. Pressure has no doubt been brought to bear in other ways. My successor as chief dairy expert has not been altogether opposed to them I understand—and is perhaps a little in favour of them.

7011. If certain firms stipulated that they should be put in because they themselves sold those preservatives, I suppose indirectly they would have to pay for those preservatives, or at all events the public eventually would have to pay for them?—Yes; but those firms simply sell butter on consignment; those firms that I was thinking of had simply the butter consigned to them, and they sold it on commission.

7012. Sold it as they could?—Yes, on commission.

7013. I understand that whilst you were in New Zealand you made directly some experiments in your position as chief dairy expert to assure yourself whether any gain was or was not obtainable by the use of preservatives, did you not?—Yes.

7014. Would you kindly tell us the results of those experiments?—The result was that we found on a number of boxes of butter made exactly alike, churned at the same time, and from the same cream—the butter that was treated with preservatives kept slightly better than that without; but the gain was a very slight one. I think the points were a maximum of 45 for flavour; the butter treated with preservatives scored at the end of eleven weeks 37 points for flavour in one case, and 36 in another, or an average of 36½; and the butter that was not treated with preservatives scored 32 to 34, showing a slight gain for the chemically-treated butter.

7015. That is to say the flavour was preserved?—Yes, the flavour was preserved to a better degree.

7016. What were the amounts in which you got the most favourable result?—A half per cent. was found quite as efficacious as any larger quantity; if you exceeded that half per cent. the flavour of boracic acid was distinctly noticeable in the butter.

7017. What kind of flavour has boracic acid—do you mean a taste?—Yes, a saline taste.

7018. What was the influence of that experiment upon your own convictions?—The experiments were not sufficiently conclusive to warrant me regarding the verdict as final, and I was still unconvinced that it was necessary to use preservatives for New Zealand butter considering the practical fact that two-thirds of the butter leaving the Colony at that time were not treated with preservatives, and reaching home in as good a condition as that which was so treated. I felt, too, on higher ground that we were running a risk of imperilling our reputation for the purity of the product; I thought unless the evidence was very strong that we should not do anything to endanger that reputation.

7019. You thought in fact that because certain shippers could do without it the rest might?—Yes, the rest could.

7020. The gain, in your opinion, was so trifling that it was not worth your risking the reputation of the butter?—Exactly.

7021. Have you anything further to add with respect to butter?—No, that is all.

7022. Now, we pass on to what you have to tell us respecting milk and cream; would you kindly say what the result of your observations and experience there is?—I am intimately connected with the Copenhagen Milk Supply Company, which was started by a relative of mine some 21 years ago on philanthropic motives, with the idea of supplying the town of Copenhagen with an absolutely pure supply of milk at the lowest possible price it could be done for. Through all those years not one ounce of preservative has ever been used in any of the milk or cream, or other dairy products sold by this company, and their sales now amount to something like 15,000,000lbs.—1,500,000 gallons.

7023. Are preservatives used at all in Denmark?—They are not used in the milk supply of towns. They are very strictly prohibited by law. The police are constantly taking samples, and I think I may say that the law is enforced.

7024. Then where are they used if used at all; you say they are not used in the milk supply of the towns?—In the smaller villages the police administration is not so strict, and preservatives may be used there. In the larger towns preservatives are not used.

7025. Why is not the law as stringent in the smaller places as it is required to be in the large towns?—I think common experience is that it is not so.

7026. But is it not the fact that the necessity, if there be a necessity, for the use of preservatives, would be more felt in the larger towns than in the smaller places?—Quite so.

7027. Then it seems odd that in a place where, if there is any gain at all in their use it is there to be found the law is very stringently set in motion, whereas in the smaller places, where the milk, so to say, is more nearly to hand, the use of preservatives is tolerated?—It is tolerated because these small villages may not have analysts and inspectors to enforce the law.

7028. Are you personally acquainted with Dr. Stein?—Yes, I was many years ago, but I have not seen him for many years.

7029. What are his functions, if he has any, with respect to the organisation which controls or checks the use of preservatives?—He is official analyst for the Government of Denmark, and for the city.

7030. Will not his jurisdiction extend over the smaller places then?—Yes, I suppose if the outside bodies were to send in samples, I am not prepared to say but what he would analyse them.

7031. Then it is not the absence of a local analyst which causes the law to be slackly enforced; it is rather the slackness of the authorities themselves?—I presume so.

7032. Your point, however, is that judging from the example of Copenhagen, it is quite possible for a large community to be supplied with milk without the use of any preservatives?—That is so, and the experiment has lately been tried in this country as well.

7033. Where?—In Manchester; I will not say that there are not other milk supply companies that deliver milk without any preservatives, but I can at all events vouch for the Manchester Company to which I am consulting expert.

7034. Are you aware of any other continental cities that carry on their milk trade without the use of preservatives?—I cannot speak authoritatively on the point. One point in the Copenhagen system that I would like to bring out is that there is only one delivery of milk per day as against the two deliveries universally practised in this country.

7035. What advantages has that system over the method here?—The advantages are, a reduction in the cost of delivery there, so enabling you to spend more money on getting pure milk from healthy cows; and in enforcing precautions as to cleanliness both on the farms and in the course of distribution without enhancing the cost of the milk to the consumer.

7036. How is that secured otherwise?—How can you secure in Manchester, or in Copenhagen, one delivery per day?—Simply through cleanliness and the strict, prompt cooling of the milk immediately that it is milked.

7037. The prompt cooling of the milk would be, of course, relatively speaking, a costly procedure, would it not?—Relatively it is; to be properly cooled it must be cooled with ice.

7038. Ice in this country is not so easily obtainable as it is in Denmark, is it?—It is perhaps more easily obtainable than is generally thought. For instance, this last winter all our farmers have succeeded in obtaining a supply of natural ice or snow, to be used during the coming summer. It is stored under peat moss or sawdust, or other insulating material, and is taken out from day to day as required. There is very little expense about it, and I may say that it can be done for about 2s. 6d. to 5s. per ton.

7039. Do you think the climatic conditions of this country are so constant that we could ensure in that way year after year a natural supply of snow or ice?—In nine years out of 10, I believe that it is possible to do so. Shortly after I came over here I consulted a Manchester gentleman, who has been in the habit of collecting ice, and snow for the last 40 or 50 years. His experience is that only perhaps four or five times during that period has he not been able to get a supply of natural ice or snow.

7040. That would necessitate, of course, that every farmer had an ice-house or some similar contrivance?—Not necessarily.

7041. How do you preserve the ice?—Simply stack it in the open as you would potatoes or turnips, and cover it up with sawdust or peat moss about two feet thick all round.

7042. Is that the way in which it is actually done by the farmers in connection with the Manchester Supply Association?—Yes.

7043. Then your point is that if the milk is sufficiently refrigerated no matter whether it be delivered once or twice a day, it would be still possible to deliver it without the use of any preservatives?—Without any preservatives whatever.

7044. But you think that if a daily delivery only could be arranged it would more than compensate itself for the cost of refrigeration?—That is our experience.

7045. And that thereby you could indeed deliver the milk somewhat cheaper than at present it is delivered?—Yes, other things being equal.

7046. Would that not rather tend to concentrate the milk supply into comparatively few hands?—Undoubtedly it would, and I think it would be a distinct gain to the community that it should be so.

7047. In the first place, it would rather tend to the concentration of the milk supply in the hands of the farmer, as well as in the hands of the vendor, would it not; I mean small farmers would not have the appliances, and could not undertake the additional cost of freezing the milk, could they?—I think so. We have suppliers who are both in a very large way, and in a very small way; I mean to say that they range from 12 or 15 cows up to 200.

7048. How many farms are worked in conjunction with your Milk Supply Association at Manchester?—There are nine at present.

7049. What is the total volume of milk you handle per day?—I would rather not answer that question; I am not authorised to give any detail as to the actual volume of the trade.

7050. How long has it been in operation?—About 12 months this month.

7051. Of course one delivery per day would no doubt have the advantage, I suppose, that the character of the milk would be more uniform; I mean so far as its quality went?—Yes; both the morning's milk and the evening's milk being mixed.

7052. We should get over the difficulty of the disparity in the richness of the fat between the morning and evening milk?—Yes.

7053. Is it your contention that a system of one daily delivery would suit the exigencies of a place like London?—I am not sufficiently acquainted with London to be able to say; but if it can be done in Manchester I do not see why it should not be done in London.

7054. Manchester, I suppose, is mainly supplied from Cheshire, is it not?—From Cheshire and Derbyshire.

7055. That is to say its gathering ground is comparatively close at hand?—Yes, it is comparatively close.

7056. What is the longest distance the milk has to travel to you from your farms?—About a four hours' journey from the farm to our depôt.

7057. Perhaps you are aware that milk coming to London travels sometimes a couple of hundred miles?—Yes.

7058. But that is not a condition of things which obtains in Manchester?—No, it does not with us, but there is no reason why it should not. If the milk is sufficiently cooled it will stand a journey of 200 miles just as well as it will one of 50 miles.

7059. Have you anything more to tell us with respect to your experience with the Manchester Pure Milk Supply Company?—I would simply say this: that though there was a great deal of prejudice against the single delivery when we first started, that prejudice is being rapidly overcome, and people are finding now that the milk will keep perfectly sweet in the hottest weather, and they rather prefer the single delivery, as it involves less trouble; the servants, for instance, have not to answer the bell twice.

7060. Do you mind telling us what is the nature of your contracts with the farmers, as to the character of the milk which they should supply to you?—The contracts are very stringent. I have not got a copy with me, but I can give you the essential outline. All the cows are tested with tuberculin every six months by our own veterinary surgeon, who is also the chief veterinary surgeon to the Cheshire County Council. They are examined clinically once a month as well. We have very strict feeding regulations. We do not allow any stall feeding in the summer, and in winter we regulate both the quality and the quantity of the food to be employed. We are very strict as to the cleanliness both of the shippons and of the utensils. We supply all the milk cans used by the farmers, and undertake the cleansing of them before they are returned.

7061. Do you stipulate as to the character of the water supply?—Yes, that is a very important point.

7062. Is that examined by you?—Yes, we examine it before we take on any farm.

7063. As to the adequacy of the supply of water?—Yes.

7064. Apart from its purity, I mean?—The cooling arrangements, of course, are very strictly looked into. We insist on every farmer cooling the milk to 40 degrees as soon as ever it is milked. If he cannot get ice naturally we undertake to supply him with it at a very low price, and, of course, we pay him a commensurate price for all this extra care and trouble that he has to take. We find that owing to the single daily delivery we can afford to do that, and yet retail the milk at a lower price than the average surrounding dairymen.

7065. Do you stipulate for a definite amount of fat in the milk?—Yes.

7066. What do you stipulate for?—Three per cent. is our limit.

7067. Do you pay him any more if he gives you any more fat in the milk?—No.

7068. What do you do if he gives you less?—We have never had such a case happen.

7069. Are you able to tell us what, as a rule, they do give you?—Yes; the average is 3·5. We take very careful tests. Every can of milk that has ever come into the dairy is tested every day—every separate can we sample and test. We have a complete record from the day of starting.

7070. What is your average; can you tell us the average amount of fat in these milks?—I could not tell you to a second decimal point, but it is either 3·5 or 3·6.

7071. When does it fall lowest?—It varies very considerably. Some farmers, we find, fall to their lowest in August, when the grass is very scarce. We have had it as low in that month as 2·7 for a single day. Of course, that is not the average for a week or a month.

7072. Do you make any stipulation as to the periods of calving—how the man should distribute them over the year—or do you leave that to him?—We insist that the calving shall be so regulated that the maximum supplied in any month shall be not more than 50 per cent. of the minimum supplied in any month, and *vice versâ*.

7073. Does it happen then that the farmers with whom you deal are practically calving all through the year?—They are calving all the year round.

7074. You have had no difficulty in getting men to comply with those regulations, have you?—We had to visit a very large number of farms in the first instance to select a few, but now as we find the business increasing we have no difficulty in picking out one from time to time.

7075. The farmers are willing to conform to those regulations, are they?—Yes, very willing. They get such a

Mr. C. W. Sorensen.

8 May 1900.

very high price for their milk that they would be ready to conform to rather more than we ask them, I think.

7076. Are the churns which are sent out always locked churns?—They are sealed with lead seals.

7077. Where do you take delivery of those churns?—At the railway station at Old Trafford.

7078. At the receiving end?—Yes.

7079. Up to that point the farmers are responsible?—Yes. Every farmer has his name stamped on the seal, and we examine the seals as they arrive at the dairy to see that they are intact.

7080. Does your company deal in separated milk?—Yes.

7081. Do you supply separated milk separately?—Yes.

7082. Is there a demand for separated milk by the consumer?—Yes, there is a slight demand, perhaps in the proportion of 5 or 6 per cent. of the whole milk.

7083. I suppose in the ordinary case of milk, the usual run of milk sophistication is the addition of separated milk, is it not?—There are a good many other things too—there is annatto, for instance. I think it is almost impossible to get a glass of milk in London that is not more or less coloured with annatto.

7084. That is not a sophistication of the same order as the abstraction of fat, is it?—No.

7085. The abstraction of fat, I suppose, is the most general form of adulteration, is it not?—I should say so.

7086. May I just take advantage of your being here to ask you another question relative to that. Do you not think it would be to the general interests of the community and of the honest and legitimate trader that some steps should be taken to ear-mark, so to say, separated milk?—To ear-mark separated milk?

7087. I mean to say, should something be done with it so that its identity as separated milk should be preserved all along the line?—Beyond selling it as separated milk and labelling the can "Separated Milk," I do not see what more can be done. Have you anything in your mind such as colouring it a particular colour?

7088. Something in principle like that. Do you know the principle of the German margarine law, for example?—I do not know that I do.

7089. German margarine is ear-marked by a certain quantity of sesame oil. Are you aware of that?—I did not know of that.

7090. The German Government, with a view of checking the surreptitious addition of margarine to butter, has required all margarine manufactured in Germany to be mixed with 11 per cent. of sesame oil, which in no way detracts from its quality, but allows of its ready identification, sesame oil not being, of course, a natural constituent of butter. Do you not think it would be a desirable thing to issue some regulation such as that separated milk should be mixed with something which would stamp it as separated milk, but yet in no way destroy whatever alimentary quality it had, nor do anything whatever to make it useless as food, but at the same time which would indicate actually what it was or allow an analyst to be able to detect the presence of separated milk?—I do not think it requires an analyst to detect separated milk.

7091. For example, if you took the milk of a Jersey cow containing 5 or 6 per cent. of butter fat, you could add a very large proportion of separated milk to that, could you not?—Undoubtedly.

7092. Who would tell you that you had made the addition?—In that case no one; I see what you mean, but I do not see how any law that you could frame would prevent the addition of separated milk before it had been so treated with this specific.

7093. It is the fact, is it not, that the evening milk is almost invariably richer than the morning milk?—Only, I think, when there is a difference in the period between the milkings.

7094. But there is always that difference more or less, is there not?—In practice, yes.

7095. You may have the difference as much as 8 and 16 hours, may you not?—Yes.

7096. The effect of that would mean a very considerable disparity in the amount of fat?—Yes.

7097. There is nothing at present, therefore, to prevent a man taking advantage of that circumstance and diluting his evening milk down to the standard of the morning milk with separated milk?—Nothing whatever.

7098. The general effect of that would be to depreciate the general average of the milk supply, would it not?—Quite so.

7099. Which is, perhaps, a desirable thing to check, is it not?—Yes, but I do not see how it can be checked by any legal remedy.

7100. At present perhaps not, but still, would it not be a desirable thing so to arrange that the separated milk should be ear-marked with something or another to prevent the addition of it in the manner I have indicated?—I am afraid that the only conceivable way to do that would be for the separator itself to impart some peculiarity to the milk on its passage through the machine.

7101. We might, however, arrange—might we not possibly—at all events, this is a conceivable idea—to cause something to be added to the separated milk which would at once stamp it as separated milk?—Yes.

7102. For example, as a suggestion, we might add a certain quantity of starch?—Yes.

7103. Some easily recognisable starch or a character of starch which is not likely to be accidentally introduced into it on a farm?—Yes.

7104. For example, rice starch, a very small quantity of that would be a sufficient diagnostic, would it not?—Yes.

7105. And the evidence of the rice starch could be very easily picked up analytically?—Yes; but how are you going to enforce anybody to put the rice starch into the milk?

7106. The German Government can enforce sesame oil being put into the margarine?—At a certain stage before it goes on to the market?

7107. At any stage you please that it is necessary or desirable to do it; and the Government of this country can force people to add a certain quantity of wood naphtha to alcohol to denature it?—I fail utterly to see how you can legislate to prevent a man adding separated milk to his whole milk before it leaves his own dairy, before it goes out on to the market at all if he runs his separator simultaneously with the milking.

7108. The exact details of how it is to be done perhaps we need not thresh out here; it is quite conceivable that by a system of inspection at the points of delivery and at the points of receiving by public officials this practice of the surreptitious use of separated milk might be stopped by the method I have indicated; that is conceivably possible—anyhow, what I should like to get from you without going into the question of how it is to be done is, is it abstractedly desirable to do it?—I do not know that it is without further thought.

7109. But you have admitted that fraud can go on?—Undoubtedly.

7110. And you think it does go on?—Yes.

7111. Yet cannot you bring yourself to say it is desirable to stop a fraud?—Certainly it is.

7112. That is all I want to know. You think it is abstractedly desirable to stop it?—To stop fraud. Yes.

7113. To stop this fraud?—Yes, to stop that fraud.

7114. Now it has been urged, has it not, that the prohibition of the use of preservatives in milk would enhance the cost of the milk to the public?—Yes.

7115. Are you of opinion that it would?—I think I have shown that it need not be so, and in Copenhagen the retail price of milk is 2½d. per quart for a milk very much superior to anything one can get in this country as a rule for the higher price, and in Manchester we have not found it necessary to raise the price above 3½d. per quart, while many dairymen in Manchester charge 4d.

7116. Have you told us all that you wish to say respecting milk?—Yes, as regards milk; but there is a point to be considered as regards cream.

7117. Now what have you to tell us about cream?—Very much the same as with regard to milk—namely, that there is no necessity for cream to be chemically treated any more than there is for milk if it is managed on proper lines. At present the cream trade, in Manchester at all events, goes on through grocers, fishmongers, and men of that sort, who take in cream perhaps once a week or once a fortnight, and sell what they can, and have the balance taken back. To enable the cream to keep for that week or fortnight, of course, it must be treated with some preservative, but I question whether there is the slightest necessity for it to keep that week or fortnight if the trade is diverted into proper channels. If it is delivered once a day along with the milk I do not see any necessity for requiring it to keep for a week or a fortnight.

7118. Then your point is that, because the grocers have sought to capture a portion of the cream trade, at all events, they require the use of preservatives?—Exactly.

7119. But that if the sale of cream were confined, as hitherto, to persons strictly in the dairy trade?—To any one who would deliver it fresh once a day——

7120. There would be no necessity for the use of preservatives?—None whatever. In Copenhagen they retail as much as two tons of cream per day in glass bottles, and they never use any preservative whatever.

7121. In Copenhagen it can be as hot as here, can it not?—Yes, fully; hotter in summer.

7122. The extremes of temperature are much greater there than they are here?—Yes.

7123. Has the cream of Copenhagen any long distance to travel before it reaches the city?—It has practically the same as the milk; it comes by rail from farms three or four or five hours away.

7124. Have you anything more to tell us about the cream?—I think not.

7125. (*Dr. Bulstrode.*) You say that 1 per cent. of boracic acid gives rise to a boracic acid taste?—Yes.

7126. (*Dr. Tunnicliffe.*) In butter that is, is it not?—Yes

7127. (*Dr. Bulstrode.*) Do you know that the agents-general of the Colonies in communicating with Mr. Chamberlain in reference to this subject stated that they had been advised that 1 per cent. would be perfectly innocuous:—They say, "But our main object in approaching you is to request you to be so good as to bring the matter before the President of the Local Government Board with a view to the exact amount of boracic acid which may be used in preserving butter being authoritatively defined." In making that statement do you think they had regard to the fact that 1 per cent. gives rise to a taste?—Was that from New Zealand?

7128. From all the Colonies—Victoria, New South Wales, Queensland, South Australia, Tasmania, and New Zealand?—I can only say that that is our experience, that 1 per cent. does give a taste to the butter—a distinctly noticeable taste.

7129. You said you could not tell us as to the conditions that obtained in New Zealand in reference to the use of preservatives in butter at the present time?—No, I cannot.

7130. You stated that you were unwilling to tell the Committee the extent of the trade of your company in Manchester; would you mind stating, if you feel you can, whether the trade is promising?—Undoubtedly.

7131. You can state that without a doubt?—Yes, I can state that the trade has doubled within the last six months.

7132. And you say that it is necessary in order that you may have a delivery once a day to procure ice?—Yes, absolutely necessary.

7133. Would you say that ice is necessary if you have a delivery twice a day?—No, I should say not.

7134. So that really with the methods of delivery which we have now, we may get on without the use of ice?—Quite so.

7135. By simply cooling with cold water?—Yes.

7136. In making your statement, which was based, I think, on the opinion of a Manchester gentleman, was it not, as to the procuring of ice and snow for nine years out of ten——?—Yes.

7137. Had you regard to the fact that Manchester is considerably more north, say, than Brighton, and that in Brighton and elsewhere on the south coast there might be some difficulty in procuring ice?—That is so.

7138. Do you think the average of nine out of ten would obtain further south—in the Isle of Wight, for example?—I am not sufficiently acquainted with the south to have any opinion on that.

7139. Do you think cooling to 40 degrees only is necessary to ensure a delivery once daily?—Yes.

7140. But you would cool to a smaller extent for twice a day?—Yes.

7141. In cream you say in your *précis* you have found as much as 157·8 grains of boracic acid per gallon?—Yes.

7142. "Out of eight samples of cream," you say, "purchased casually in Manchester in February, all of which were found to contain preservatives, four, or 50 per cent., contained from 144·7 to 157·8 grains per gallon"; do you think that is a usual practice?—I think it is almost invariable.

7143. And in that amount?—In those approximate amounts.

7144. You think those are fair average amounts?—Yes; these samples were taken in February, when the weather is distinctly cool.

7145. You have got no figures of samples taken in August, have you?—No.

7146. (*Dr. Tunnicliffe.*) When you say that 1 per cent. of boracic acid tastes in butter, do you mean that it tastes *per se*, or that it alters the taste of the butter in a certain way?—One notices a peculiar flavour in the butter.

7147. What do you think that is?—One is at a loss to attribute it to anything but the preservative.

7148. But if you did not know the boracic acid were in the butter you could not recognise the boracic acid as such, could you?—No, one might not.

7149. It might be any other preservative, for instance?—Quite so.

7150. Then what it amounts to is that it alters the taste of the butter?—Yes, it imparts a taste to the butter.

7151. I should like you to tell the Committee, if you can, something with regard to the social standing of your *clientèle* in Manchester; are they amongst the better classes?—They are very mixed—both amongst the better and the poorer classes.

7152. And the majority is amongst which class?—The middle class.

7153. In short, amongst the people who have fairly good domestic appliances for keeping milk?—Yes, quite so—not amongst the very poorest, because the very poorest are supplied in Manchester with milk at 2½d. per quart—such as it is.

7154. Do you know anything about the hygienic conditions of the poor classes in the large towns of England?—Not more than an ordinary individual does.

7155. How do you think they would compare with regard to space and appliances for keeping milk with the conditions of the lower classes in Copenhagen, for instance?—I do not think they would compare altogether favourably.

7156. Do you think that the poor people in Copenhagen would have a better chance of keeping their milk domestically than the poor people of London?—I should say so.

7157. You supply direct to your customers, and you have no dealings with middlemen whatever, I understand?—No, none whatever.

7158. I understood you to say that the fact that you delivered milk only once a day enabled you to keep the price of milk down in spite of the somewhat more elaborate *technique* which you use?—Quite so.

7159. So therefore if milk had to be delivered twice a day you would not be able to do it at the same price?—Yes, we should, because one would not need to use ice in that case.

7160. You think those two conditions would balance each other?—I think so.*

7161. Did you make any experiments with any more than 1 per cent. of boracic acid?—No, that was the maximum amount used.

7162. Speaking roughly, would a higher percentage, do you think, have a better preservative action than one per cent.; do you think, for instance, if you put 2 per cent. in it would keep the butter longer?—If there is any

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* I would like to correct this; if I really did make this statement it must have been under a misapprehension. As I stated in *Qs.* 7033 and 7158 it is distinctly owing to the economies effected in having only *one* daily delivery that we can pay an extra high price to our farmers for a perfect milk, and yet retail the same to the public without raising the price above the average. If we had to give two daily deliveries we should have either to charge more or forego some of our precautionary measures. My point is that, if *we* can do without preservatives while delivering only *once* a day, those who deliver *twice*, even without using ice, can also do without them. I wish to correct my statement that the saving in ice will balance the additional expense o a second delivery.—*C. W. S.*

Mr. C. W. Sorensen.

8 May 1900.

preservative action in it, I should say that it would, but then you have the question of taste; you would make the butter altogether useless from the taste point of view.

7163. Two per cent. would make it quite useless, you think, from the taste point of view?—I should think so.

7164. Are there any special precautions with regard to the transit of milk and butter in New Zealand?—The Government supply refrigerator railway cars on their own lines for butter, and the steamship companies that run to meet the mail steamers also supply insulated space.

7165. Are there any such appliances in Denmark?—For butter?

7166. And for milk?—Yes.

7167. For both?—For milk the Copenhagen Company has its own railway vans, which it keeps supplied with ice itself.

7168. And for butter?—For butter, I think the Government provide refrigerator cars.

7169. But you have no such appliances in Manchester?—None whatever.

7170. Your milk and butter are carried, so to speak, haphazard by the railway companies?—Quite so.

7171. (*Professor Thorpe.*) The greater portion of the milk supplied in Denmark is sterilised or pasteurised, is it not?—No, I should say not the greater portion.

7172. Is not the greater portion of the milk supplied to the city of Copenhagen pasteurised?—No.

7173. Is not any large proportion pasteurised?—A considerable proportion is pasteurised, but I should not say it was the greater proportion.

7174. Would that not have something to do with the keeping qualities of the milk?—Undoubtedly; but none of the Copenhagen Supply Company's milk is pasteurised—none whatever.

7175. Do you contemplate the necessity of pasteurising in Manchester?—No, we are entirely opposed to the practice.

7176. Why are you opposed to it?—We are opposed to it because it is unnatural, and we believe that it is injurious to very young children or invalids who are fed on it.

7177. Why?—That is on medical advice.

7178. In what sense is it injurious?—It is less digestible.

7179. What does pasteurising the milk do to it chemically?—It caramelises the milk sugar and it coagulates the albumen.

7180. Is the temperature sufficiently high to caramelise the milk sugar?—It does; it imparts that peculiar taste.

7181. I may be wrong here, but I understand—and I have it on the authority of Mr. Faber—that properly pasteurised milk has no taint or flavour?—I am afraid I cannot agree with Mr. Faber though.

7182. You think it has?—Absolutely.

7183. Anyhow you have deliberately in Manchester decided not to sterilise or pasteurise?—Yes.

Mr. A. R. Anderson.

Mr. Alexander Richard Anderson, called; and Examined.

7184. (*Professor Thorpe.*) You are a Fellow of the Royal College of Surgeons?—Yes.

7185. And you are surgeon to the General Hospital, Nottingham?—Yes.

7186. You have had some experience, I believe, in prescribing boracic acid?—Yes, I have.

7187. And in observing its effects?—Yes.

7188. Would you kindly tell the Committee what that experience is?—I began to prescribe boracic acid chiefly in cases of bladder trouble in the year 1892, and as I found it to do good in such cases I have continued its use since both in hospital and in private practice. When I began to prescribe it I was not aware that it caused any unpleasant or harmful symptoms, and my attention was first directed to it by the patients themselves. My experience has been chiefly among adult males, and the drug has been prescribed in doses of from 10 to 20 grains three times a day. My experience has been that after taking the medicine in these doses the majority of cases within a fortnight will begin to complain of dyspeptic symptoms. By that I mean such symptoms as pain, referred to the region of the stomach, uncomfortable sensations after eating, loss of appetite, weariness, giddiness, nausea, and in some cases actual vomiting and eruption on the skin. On discontinuing the medicine the symptoms quickly subside, and they reappear again when the administration of the drug is resumed. This has occurred so often in my practice that I am in the habit of telling the patients that the medicine will probably make them dyspeptic, and that when such symptoms occur it must be discontinued for a time until they are all right again, and then resumed. Since the 1st January this year I have prescribed boracic acid in these doses to 14 patients, and out of that number eight became so dyspeptic that I had to omit its use. The symptoms produced by boracic acid are not, as a rule, serious, and they always quickly subside when the drug is discontinued. But the dyspepsia in my experience is sufficiently pronounced to make life miserable, while it lasts, and at times it causes distinct gastritis, with repeated vomiting. That, gentlemen, therefore, has been my clinical experience of the administration of boracic acid.

7189. Does that experience lead you to recommend that the use of boracic acid in the relatively small quantities in which it is present in milk as a preservative should be prohibited?—Yes, for this reason, that I take it the average amount of milk adulteration with boracic acid is about five grains to the pint. If a healthy adult takes a small quantity of milk twice a day the amount of boracic acid in it would be of no detriment to him whatever, but if you take the case of a child two years of age the dose for a child of that age, according to the posological table which you will find in any work on materia medica, would be $2\frac{1}{2}$ grains three times a day—one-eighth of the other that is—that would be equivalent in a child two years old to a dose of 20 grains three times a day for an adult man. A child consuming two pints of milk boracised to the extent of 5 grains to the pint, would be getting 10 grains of boracic acid a day, whereas the maximum dose for such a child would be $7\frac{1}{2}$ grains. Then, again, take the case of an adult, who is ill, and who has fever, and so forth, and who is fed exclusively on milk. If he took four pints a day, he is then getting 20 grains of boracic acid per day with his milk. His stomach being already very seriously disturbed, as in a case of typhoid, where milk is the chief article, or perhaps the sole article of diet, I say, in my opinion, that would be doing him harm rather than good.

7190. When you say would do him harm rather than good, do you mean to say it would do him serious harm?—That is a very difficult question to answer, but it certainly has an irritating effect on the stomach, which, in the case of typhoid fever (speaking not as a physician, but as one practising wholly as a surgeon), I should imagine would be the very thing one wants to avoid.

7191. In the course of your experience as a practising surgeon, you have used boracic acid outwardly as an antiseptic, I suppose?—Yes; but not to any extent, because it is a very feeble antiseptic. We use stronger antiseptics when they are wanted. I use boracic acid very little. I use preparations of mercury more.

7192. You have had no experience of skin eruptions following from the use of boracic acid as an antiseptic in surgery, have you?—No, not as an antiseptic.

7193. (*Dr. Bulstrode.*) At the hospital at which you are surgeon, is it the custom to have the milk examined for preservative?—Yes.

7194. How long has that been so?—About six months.

7195. At whose suggestion, or as the result of whose experience?—At the suggestion of the Medical Committee.

7196. For what preservatives is the milk examined?—That I am not sure of, but it is done by the City Analyst, and he sends in his report to us that it is free from preservatives or otherwise, but boracic acid is within my knowledge one that he tests for.

7197. Do you regard it as an important matter to physicians and surgeons in hospitals that they should know whether their patients are taking drugs in their food, some of which they have been in the habit of prescribing?—Certainly.

Mr. A. E. Anderson.

8 May 1900.

7198. It may tend to stultify the position of the physician unless that is done?—Yes; there was a very marked case that gave rise to the analysis of milk in question; but I do not know quite whether this is a thing that ought to be made public, because the milkman might easily be traced, and it might reflect upon him.

7199. I think the Committee is already aware of that fact. I think one of your colleagues here pointed out to us that within his own knowledge he treated a case, I think it was in the hospital of Nottingham?—That is the case which I am referring to.

7200. (*Dr. Tunnicliffe.*) It was the case of one child?—Yes.

7201. (*Dr. Bulstrode.*) That is the case you are basing your statement on?—What statement.

7202. The statement you were giving as an illustration of the danger of the indiscriminate use of these preservatives in relation to the medical practitioner?—Yes, that is one instance.

7203. Can you supply others. We have had that instance before us?—I have had no experience practically of the adulteration of food—I mean of boracic acid in food, causing harmful symptoms.

7204. Then on general principles you think it desirable that the physician should know whether or not the milk which is supplied to his patients contains drugs which he may be prescribing for them professionally?—Certainly. If my clinical experience is worth anything at all a child taking 10 grains of boracic acid a day in milk, which it may very well do, ought to be made seriously dyspeptic by it.

7205. Are there any conditions which contra-indicate the use and administration of boracic acid?—I think it would do harm in any disease associated with fever, where the stomach and intestines are already in a state of irritation, such as typhoid fever, for example.

7206. Do you think in typhoid fever that boracic acid should be administered with caution?—Boracic acid, I think should. It is contra-indicated, because it is an irritant to the mucous membrane of the stomach and the intestines too. I am convinced of that.

7207. That being so, you would object to the indiscriminate use of boracic acid in milk?—Yes.

7208. Can you tell us any other conditions under which the administration of boracic acid is contra-indicated?—I think in the case of a complaint, where a person is already ill, or so seriously out of sorts from any disease that he is put on a milk diet, it should not be administered. Taking adult males, as I have already said, a man may take from 15 to 20 grains of boracic acid with his milk daily, and I cannot conceive an illness, associated with fever in the case of a person so seriously out of sorts, that be already had to be put on a milk diet, in which he would not be rather harmed than otherwise by its administration.

7209. Would you give boracic acid in the case of acute nephritis?—It is rather outside my province to treat acute nephritis, as I am practising as a surgeon; but, personally, if I had to prescribe for a patient of that sort, I should not give it. I should not expect any good to result from it.

7210 Have you any experience as regards the use of other preservatives than boracic acid?—Practically none.

7211. Have you anything to tell the Committee as to the use of salicylic acid?—My experience is not worth much. I have prescribed salicylate of soda, but that, of course, in any considerable dose produces very distinct symptoms—noises in the ears, and so forth—and you cannot continue the use of that beyond a certain point.

7212. Is that due to the drug itself ordue to the impurities contained in it?—I think to the action of the drug itself.

7213. (*Dr. Tunnicliffe.*) Would you regard the treatment, for instance, of infantile diarrhœa by boracic acid in suitable doses as being bad treatment?—Yes, I should say it was. Do you mean as an intestinal antiseptic?

7214. Yes?—I think in small doses it could produce no antiseptic effect whatever. It is very difficult to sterilise the urine with 20-grain doses. I do not think it could produce the desired effect given as an antiseptic. It is a very mild antiseptic, and you would have to give good big doses to get any antiseptic effect.

7215. You think its irritant action would be out of all proportion to its antiseptic action?—Quite so.

Dr. Philip Schidrowitz, called; and Examined.

Dr. P. Schidrowitz.

7216. (*Professor Thorpe.*) You are Doctor of Philosophy of the University of Berne?—Yes.

7217. You are Fellow of the Chemical Society; member of the Society of Public Analysts, of the Society of Chemical Industry, of the German Chemical Society, and you are author and joint author of various papers and treatises on chemical subjects, and you have had some years' experience as an analytical and consulting chemist?—Yes.

7218. I believe you wish to offer evidence before this Committee on the use of preservatives in beer and milk?—Yes.

7219. You have already given evidence, I believe, before the Pure Beer Committee?—Yes, before the Beer Materials Committee in 1898.

7220. That evidence included evidence on the use of preservatives in beer, did it not?—Yes, it did.

7221. The evidence, therefore, that you wish to give on beer to-day is here in the Blue Book, is it not?—Yes, it has practically all appeared with regard to beer, but not with regard to milk. That is quite apart from the other.

7222. Then under those circumstances I do not think it is necessary to take you over that evidence, as it is already in print and available to us?—No, perhaps not. (*See App. No.* 34.)

7223. Then we will turn to the question of preservatives in milk. What have you to tell us now in respect to the necessity or otherwise of using preservatives in milk?—I recently had an opportunity of making some experiments with regard to the refrigeration of milk which I think might be of interest to the Committee. I do not wish to give any evidence as to whether preservatives are harmful or not. It is not a matter for me at all. I wish merely to bring these experiments before the Committee. I think they tend to show that if milk is properly refrigerated—whether that is practically possible or not I do not wish to say—there is no need for the use of expressed in the subjoined tables (*see Appendix No.* 35), according to Thorner, as degrees of acidity, that is the quantity of one-tenth normal alkali necessary to neu-

7224. Would you just tell us what the experiments are?—I recently had an opportunity of taking and examining some samples of genuine milk, both cooled and uncooled, the temperatures of which were controlled from the time of milking and cooling up to the point at which the milk turned sour, or, rather, reached a certain point of acidity, or coagulated on being immersed in boiling water. Experiments were made (*a*) with milk which had been cooled to 10deg.—10·5deg. Centigrade immediately after milking, and (*b*) with milk which had not been cooled. Before I go to that, would you care for me to read out the references which I have with regard to the work which has been done on the refrigeration of milk?

7225. I think we have had practically all the historical part of the matter already brought before us, so if you confine yourself to your own experiments it will be better?—Certainly. The milk was transported from the country to London in a specially constructed churn provided with a water jacket and a maximum and minimum thermometer, and the experiments were started as soon as possible after the arrival of the same. In each case the milk was divided into two separate batches, one of which was kept at a temperature of 15deg. Centigrade, the other being incubated at 25deg. Centigrade. Each batch consisted of five samples: *a* being milk without any addition of preservatives; *b* containing formaldehyde 1 to 50,000; *c* containing formaldehyde 1 to 25,000; *d* boric acid 1 to 3,000; *e* boric acid 1 to 2,000. I do not suppose it is necessary for me to say why I took those quantities in view of the evidence which has been already given before the Committee?

7226. No, I think not?—From time to time 25 cubic centimetres of each sample were taken out of the containing vessel (glass bottles stoppered with cotton wool), diluted with 50 cubic centimetres of distilled water, and titrated with one-tenth normal alkali, using phenolphtalein as an indicator. The results of these titrations are expressed in the subjoined tables (*see App. No.* 35), according to Thorner, as degrees of acidity, that is the quantity of one-tenth normal alkali necessary to neu-

Dr. P. Schidrowitz.

8 May 1900.

tralise 100 cubic centimetres of the milk. I have not expressed it as lactic acid, as the acidity of the milk is, to a great extent, not due to lactic acid, at any rate in new milk. There is practically no lactic acid at all in the latter. Of course, I am not giving that as information to the Committee, but merely as an explanation of why I did not give the acidity in terms of lactic acid.

7227. As the reason why you did not express the acidity in terms of the normal amount of lactic acid?—Quite so. According to Thorner milk coagulates on boiling when the acidity reaches 23deg., but in the milks examined by me the coagulating point was somewhat higher, being roughly between 25 and 26deg. Preservatives apparently slightly raise the point of coagulation. The following are the details of the experiments.

7228. Perhaps you will briefly summarise what your tables indicate?—The first experiment made with the mixed evening milk of eight healthy cows, two Jerseys and six Shorthorns, on a diet of mangels, hay, barley meal, and equal parts of cotton and linseed cake, was strained, and then rapidly cooled to 10·5deg. Centigrade. I may say that I actually saw the milking. The milk was then brought up to London by myself in the water-jacketed tin alluded to above. The maximum temperature attained by milk prior to starting experiments was 10·5 Centigrade. The experiments were started nineteen hours after milking, and the initial acidity of milk was 14·7deg. In the second course of experiments the only difference was that it was morning milk instead of evening milk, and the milking vessels were scalded immediately prior to milking. I was informed that the milking vessels were scalded from time to time as is usual, but I thought I would like to have them done immediately prior to milking in this case. The maximum temperature of milk prior to the experiments was slightly higher than before, namely, 11deg. Centigrade as compared with 10·5deg. in the first lot. In the third experiment the milk, morning milk, was not cooled in any way, but otherwise it was treated just as in the case of the first two lots. The maximum temperature prior to experiments was 29·5deg. Centigrade—that is to say, outside the body, of course—and the minimum temperature 22deg. Centigrade.

7229. (*Chairman.*) What season was this?—This was done about six weeks ago. The cows were stalled then.

7230. (*Professor Thorpe.*) Now, what do you infer from these experiments—what do they seem to you to teach?—The point at which the milk coagulates (measured by degrees of acidity) on immersing in boiling water is apparently somewhat affected by both formaldehyde and boric acid. The curdling point (natural coagulation) is very much retarded by both formaldehyde and boric acid. The degree of acidity is no absolute criterion of the quality of the samples. This applies chiefly to the samples containing preservatives—that is to say, a milk may have a relatively low degree of acidity and yet not be fit for consumption. Both formaldehyde and boric acid appear to exercise a selective influence on the organisms which produce changes in milk. This is illustrated by Experiment II., where apparently some organism possessing the power of causing a peculiar stench in milk was present. I cannot say how that organism, which I imagine was present, got there, as the cows were well in each instance, and they were healthy cows—there is no doubt about that.

7231. Do you regard it as an abnormal organism, or as one that ought to be present in milk?—Abnormal, I should say. In the case of the unpreserved (blank) samples, this smell did not become apparent, probably because the growth of the lactic acid or other normal bacteria kept the former from developing. On the other hand the sample containing formaldehyde 1 to 25,000 displayed a most unpleasant odour when the degree of acidity was still much below the ordinary limit. This odour became gradually less strong as the degree of acidity increased; and when the sample finally curdled, had quite disappeared. The phenomena noted above corroborated the evidence on these points already in existence. I do not desire to generalise widely from the facts recorded above, but they appear to confirm the opinion held by authorities with regard to adequate refrigeration in the first instance, and to the storing of milk at a moderate temperature in the second. I may say I have not had an opportunity of seeing all the evidence given before this Committee, but I do not know of any actual experiments which have been made with regard to the cooling of milk in connection with the use of preservatives.

7232. You mean as to the necessity of dispensing with them when the milk is cooled?—Yes, I mean parallel experiments.

7233. We have had a good deal of evidence on that point both direct and indirect?—My experiments tend to prove: (a.) That milk taken under rational conditions from healthy cows, may, if cooled after milking to 10—11° Centigrade, and subsequently stored at the moderate temperature of 15° Centigrade (a temperature which should cause no difficulty except, perhaps, in exceptionally hot weather), be kept sweet for about sixty hours after milking. That milk which has not been cooled, but otherwise treated in the same way, will not keep for more than roughly half this period. That milk which has not been cooled cannot be kept for the same period as cooled milk (without preservatives) even by the use of formaldehyde in strength 1 to 50,000 or of boric acid 1 to 2,000, and that although the use of 1 to 25,000 formaldehyde keeps down the acidity even in uncooled milk (kept at 15°) for a very long time, yet it by no means follows that the milk remains normal or fit for food purposes. That milk which has been cooled in the first instance to 10-11°, but is subsequently exposed to a high temperature, will not keep longer than thirty to thirty-five hours after milking, or ten to twenty hours after exposure to a high temperature (summer heat), and that under these conditions relatively large quantities of preservatives are ineffective over any length of time. That milk which has not been cooled, and is subjected to a high temperature will only keep for a very short time (ten to twenty hours after milking), and that under these conditions also preservatives are of little use. I may say that although the numbers given in the above remarks would naturally vary with different milks, yet I believe that broadly speaking they would hold good within reasonable limits. I believe that a regulation providing for the adequate cooling of milk for sale (I would suggest 15° Centigrade as a minimum) would be of very great benefit. I have said 15° Centigrade, on account of the work of Soxhlet and Enopf, who showed that above 15° the multiplication of organisms becomes very rapid, while below 15° it is moderate.

7234. Then, if we may generalise from the whole of the evidence you have given us, the inference is this: that you say provided means are taken for the adequate cooling of milk, you see no reason why the common preservatives which are mentioned should be used?—Yes, that is what I wish you to infer from my evidence.

7235. (*Chairman.*) When you say that you recommend regulations for the adequate cooling of milk, do you mean statutory regulations?—Yes, quite so. I mean a legal measure, passed and enforced for the cooling of milk.

7236. Immediately after milking?—Yes, immediately after milking.

7237. It would be rather difficult to enforce, would it not?—I think in some cases there might be a difficulty, but I do not know that there would be any great difficulty in cooling to 15° if there is an adequate water supply.

7238. I do not mean in that respect; but it would be rather difficult to enforce the regulation. How would you propose to enforce it over a district supplying a creamery where you could not have inspection in each part to see that the regulation is carried out?—I should think a visiting inspector would be sufficient to control the matter if the water supply is adequate, and if the cooling apparatus is adequate.

7239. Who would appoint him? What I mean is it is no use making recommendations unless you have seen how they can be carried out?—I quite see that, but at the same time I do not know that I am fully qualified to give any opinion as to how they should be carried out, but I do not see any very great difficulty in carrying them out if a law were passed that milk should be cooled to such and such a temperature. Then I suppose anyone who had not an adequate water supply would not be able to continue sending his milk up to the creamery or to the town as the case may be.

7240. But I put the difficulty before you. Take a creamery which is supplied by 50, or 80, or 100 farms. How could you enforce the cooling of milk in all these small farms?—I should start from this, that an adequate water supply is at present, I believe, supposed to exist in every dairy, and if there is an adequate water supply you would have very little difficulty in cooling the milk to 15°.

7241. But that is not the difficulty. I have not said that there would be a difficulty in cooling it. The difficulty would be in enforcing the cooling. However, if you recognise the difficulty that is all I want?—I daresay there would be some difficulty, but I do not see that there would be an unsurmountable difficulty.

Dr. P Schidrowitz.

8 May 1900.

7242. It involves the appointment of inspectors?—Yes, quite so.

7243. By whom are the inspectors to be appointed—by the Local Government Board?—I take it that would be the proper body, but really I would rather not give an opinion upon that.

7244. You have not thought that out?—No, I have not thought that out.

7245. (*Dr. Bulstrode.*) May we take it that your experiments tend to show that the lactic acid-producing bacteria are less resistent to preservatives than other bacteria—there may be bacteria which may produce but results, but the presence of which is not detected by acidity?—Quite so.

7246. That is the drift of your evidence?—Yes.

7247. (*Dr. Tunnicliffe.*) I should like to ask just a question with regard to beer. Have the conditions in any way altered since the sitting of the Beer Materials Committee?—With regard to the use of preservatives do you mean?

7248. With regard to any condition whatever, as far as you know?—I should say that the use of salicylic acid is decreasing if anything, but I do not know that there has been any other very great alteration since then. The use of sulphites is increasing—there is no doubt about that, and the use of salicylic acid is decreasing, but apart from that I do not think there has been any great alteration.

7249. You have done nothing in the matter of preservatives in beer since the evidence before the Beer Committee, which you would like to bring before this Committee, have you—there is nothing fresh, is there?—No, there is nothing fresh.

7250. Now, with regard to the question of milk. Any regulations which might be enforced with regard to the cooling of milk at the time of milking would not be very potent if an arrangement were not made for cooling milk during transit, would it?—I think that initial cooling would help a very great deal even if no special precautions were taken during transit, but it would certainly be a great deal better if precautions were taken during transit as well. If you reduce the temperature, say, to 15° to start with, by the time the milk reaches town, say, 40 or 50 miles off, it will hardly get to a very high temperature; at any rate nothing like the temperature that it would be at if it had not been cooled.

7251. What I wanted to ask you specially was this: Do the remarks you make with regard to the use of preservatives apply to the present haphazard method of treating milk by the railway companies?—To a very great extent certainly. I certainly think that if cooling chambers were provided, as they are, I believe, on some parts of the Continent, it would be a very great help, but I think the initial cooling of the milk is the more important matter.

7252. (*Chairman.*) Why do you fix 15°?—I fix 15° because, in the first place it would be a temperature which would not be very difficult to attain, and in the second place because there have been some experiments made, as I believe I have said, by Soxhlet and Enopf, which prove that up to 15° the multiplication of organisms in milk is not very rapid, and above that it becomes very rapid, and there is a table which I give here of the period of coagulation after milking when kept at various temperatures. When kept at 17½° it coagulates within three hours after milking; at 15° within 88 hours, and at 10° within 99 hours, so that there is no very great difference between 15° and 10°, but there is a very considerable difference between 17½° and 15°, and that is why I suggested 15° C.

7253. 15° is higher than the normal temperature of spring water?—Yes.

7254. (*Professor Thorpe.*) 15° is the average temperature in this country?—Yes. I think spring water would be probably a little below 60° F. on the average.

7255. (*Chairman.*) There would be no difficulty on the average in reducing milk to that temperature, would there?—I think not, except perhaps in the very hottest weather, and that would occur very seldom.

7256. (*Dr. Tunnicliffe.*) What is the maximum temperature that your maximum thermometer recorded during transit?—In which instance.

7257. In the maximum one?—That was in the uncooled sample, of course. The maximum temperature recorded was 29·5°.

7258. That is Centigrade?—Yes, Centigrade.

7259. Was that in February or March?—In March last.

7260. In the cooled sample what was it?—In the cooled sample the maximum was 11°, and that, of course, had been cooled to 10·5°; it had only gone up about half a degree, and, of course, it was in a vessel which was enclosed in a water jacket.

7261. So that really it was not comparable with the transit of milk under ordinary conditions for that reason, and partly from the season of the year?—No, hardly.

Mr. HENRY SYMONS, called; and Examined.

Mr. H. Symons.

7262. (*Chairman.*) You are a partner, I believe, in Messrs. John Symons and Co.?—Yes.

7263. They are cider merchants?—Yes.

7264. And you come to tell us what is the practice with regard to the employment of preservatives in cider?—Yes.

7265. Is it universal?—I do not know that it is universal, but I think some of the best makers use a very small quantity.

7266. What is the material they use?—Some use a little salicylic acid and some use saccharin; some use the two combined, I think, and others use sulphite of lime or soda, and various other compounds are used, I think.

7267. What do you mean by saccharin?—The soluble saccharin that is sold.

7268. Do you mean a product of coal tar?—Yes.

7269. That is what is known as saccharin?—Refined saccharin.

7270. I ask that because I have here a prospectus setting forth the advantages of saccharin, and in particular of the Tigress Brand?—Yes, that is the same thing as soluble saccharin.

7271. Is it the identical material?—Yes.

7272. Are you quite sure?—I consider it is. If it is what is sold by Messrs. Wilson and Salumon that is very much the same. It is supposed to be made by another process, but I consider them to be very similar. I do not think it is used very largely.

7273. Do you think it is necessary to use preservatives in cider?—I think many speak against preservatives, but I may tell you I have studied the matter from Pasteur's researches in France in 1876. In fact, I read the book myself, and about 1880 or 1881 I wrote him to know if I should do right to publish it in England, and he wrote to say he was engaged for the French Government, and he declined to allow it, but I may say I have studied the matter for the last twenty-five years. I have studied the germ theory thoroughly, and I find that the judicious use of preservatives is good, but they must not be used to the extent that some people recommend, even the Germans or the French. If they are used sparingly under certain conditions, depending partly on the state of the liquor, and on the season of the year, and the state of the fruit, and the age of the cider, they are not harmful, but we have to take all these things into consideration. My opinion is that where you have a cider that is rather low in alcohol, which some of our ciders are in some seasons, a very small proportion, say one-eighth of an ounce per pipe of 116 gallons, is a very small quantity, but still it has an effect. In the case of viscous fermentation—that is the ferment that causes the turbidity—I mean, of course, the sick fermentation, if the germs are allowed to grow in the liquid it is difficult under some conditions in the hot season or from climatic changes to prevent them growing, and if you use a very small proportion of preservative it is done to prevent their growth. I may tell you that now I am trying to separate some germs from different apples in order to be able to counteract the effect of the special germ that gives us the trouble—the putrid germ—or I will not call it the putrid germ, but it is the one that gives the characteristic of sick fermentation. In fact, I have known the liquid to be good one day and by the next day to be sick of ferment. I do not believe in using preservatives to prevent acetic acid. I think if people get it it shows great negligence, and it would require a great deal to

Mr. H. Symons.

3 May 1900.

prevent acetic fermentation. The vinegar ferment is, of course, stronger than the other, and hence it would require more to prevent it.

7274. What produces sick beer or cider?—It is the wild yeasts or disease ferments—it is called viscous and sick fermentation. It is akin to putrid fermentations. If among those present there are any chemists they will be well aware I presume of that, and they will understand it. I suppose some gentlemen here thoroughly understand fermentation, and those who do would say that if those ferments are found in cider or beer it would be advisable, if possible, to arrest their growth. If you get cider with rather a low percentage of alcohol and a good deal of body—that is, cider that would weigh from 10 to 12lbs. per barrel, it is very difficult to preserve it. I may say I met Mr. Lott, of Burton-on-Trent, three or four years ago, and he was very much interested in what I was doing. You are aware that some apples resist decay very much longer than others, and if you take the germs from those apples that stand longest and use them in fermenting liquor containing unsuitable germs or those that are not very strong and healthy, but which are short lived, I have no doubt they would overcome and eat up, so to speak, or crowd out, the inferior ones. I may tell you that I find that the germs are first produced on the leaves, and I found out last year that each apple leaf contains many different germs, and I have made cider from germs produced from one apple leaf that will be quite different in character from the germs produced from another apple leaf.

7275. But at present you have not arrived at any definite solution?—Yes; through a series of experiments extending over many years. I remember I was one of the first to study it when I went out to America twenty years ago. I went out to America twice. We formerly shipped a good deal of cider there, and we thought of putting up mills, but when we shipped the cider we found it would not stand the carriage at all. I presume this will not be published—it is quite private here, I suppose.

7276. You must not tell us anything you do not want to be published?—I should imagine that this inquiry should be private; you can hardly expect any one who has had a good deal of experience in fermentation to come and give away all his experience for nothing to be published to the world.

7277. This is a public inquiry, and, therefore, you must use your discretion as to what you tell us?—Then I fear I shall not be able to go very far.

7278. I gather that you have used preservatives hitherto?—Under certain conditions.

7279. What are those conditions?—The conditions are that if you have a liquid, say, under a certain percentage of proof spirit, which you find on testing is unstable or is likely to be when sent out for consumption.

7280. But I cannot go into all these details?—These are the things that should guide you in forming an opinion, if I may be allowed to say so.

7281. I will tell you what I want to get from you. You say that the use of preservatives in the manufacture of cider ought not to be prohibited?—I certainly think it ought not to be prohibited, but there should be limits given.

7282. As to the quantity used?—As to the quantity used. Certainly it should be so, and that is very important. You know if you preserve fresh meat—taking a piece of pork—you would hardly object to sprinkling a little salt over it, or, in cheese-making, you would not prohibit salt which is used as a preservative.

7283. I think we may dismiss that argument by the consideration that salt is a natural food, and although it is a preservative, it is not a preservative in a technical sense?—No, I quite see that difference. I should certainly object to a large quantity of preservative being used; but under certain conditions it is certainly advisable to use it, because preservatives prevent poisonous fermentation, which is very deleterious for any one to take into one's stomach. Salicylic acid is, in a sense, food, but that must not be largely used, and cider contains an acid which, to some people, is a specific almost for gout and rheumatism, and to others is quite the reverse. Salicylic acid, used in very small quantities, is a specific for gout, and certainly it would do more good than harm if it were used in very small quantities; but it must not be used in the proportion that the Germans use it.

7284. More good than harm to what or to whom?—To the human body—to the human system.

7285. Then you assume that everybody would be better for a daily dose of salicylic acid?—No, I do not; but I would rather have that than have cider liable to go wrong. A daily dose would be a very small quantity. The quantity would have to be so infinitesimal that it would be easy to get over the purpose required, that is to prevent this putrid fermentation, if I may call it so. We do not use it universally, but only at certain times, because, as you know, things change, and the seasons change, and the fruit is different. Half the quantity that we use would be taken up in the wood and the lees, and our cider would only show a trace. The main portion would go into the cask to preserve the wood and kill the bad germs in the wood, and be taken up with the lees. So that as the cider came up to the public it would only contain a trace. But we do not use it universally. You were speaking about prohibiting it, and I say I certainly think that there would be an objection to prohibiting the use of it, because I believe it does more good than harm; but I suggest that you should have a standard, and that you should not allow more than a certain quantity.

7286. Can you state any limit?—Yes. I would say it should not be more than from half an ounce to an ounce per 116 gallons.

7287. Of what?—Of salicylic acid. It is a very, very small quantity.

7288. And what of saccharin?—Of saccharin from one-eighth to a quarter of an ounce.

7289. Do you think that that is a proper use of saccharin as given in the prospectus to which I have referred; it is recommended for cider, and for beer, amongst other things. It says: "As a Cure for 'Sick' Beers. Even when such a dubious lot of beer already begins to show signs of incipient 'taint,' there may yet be time to save it by quick action in introducing, as may be needed, from one to two ounces of saccharin ('Tigress' Brand) per 500 gallons, and thereby arresting the souring process and at once making the beer drinkable and marketable"?—It would be too late to do it once fermentation has set in.

7290. And that would apply to cider also?—Yes; and I should say we should not use it in the manufacture, but after the manufacture, and before it is sent out to the public. Most of it would go off, and some short time of from one to three months before it is sent out to the public I should advise it being used. A great deal would go out into the lees and into the wood, and purify the lees and purify the wood. In making these preservatives people use sometimes more than they should do, and, therefore, I should thoroughly recommend that there should be a limit placed upon its use, and if there is more than that limit shown there should be action taken. As to salicylic acid, I ought to mention that I found it a good preservative in certain cases, although we do not use it universally; but when it came before the Courts in 1886 the decision was given against the prosecution. A number of experts showed that it did more good than harm, and the case was dismissed. I go on that. There was a sufficient number of experts called to show that the salicylic acid used in cider did more good than harm, and so the case was dismissed—there was no decision against it; and, therefore, one would naturally suppose after that that it would be right to use a certain proportion of it; but it would be only the very best makers who understood the business that should be allowed to use it.

7291. You are indicating rather difficult lines for legislation, are not you?—Yes, certainly.

7292. Would you have a competitive examination in cider-making before anybody was allowed to use preservative?—No, I should not do that; but our process is more difficult than brewing, because it varies more.

7293. Are you aware that evidence has been given before us on behalf of the cider industry that it is quite possible to make cider and perry without preservatives?—I have heard of a gentleman being here who said that, but he has not had very much experience yet. At Butleigh, where they have been making it this last year, a large proportion of cider went bad. The time may come when we shall be obliged to use them in order to get to perfection. If you get a thing up to perfection, the thing being very sensitive, it is like fever amongst cattle—very often it attacks the best beasts; and so if you get a very delicate beverage working up close to the maximum in regard to sweetness and palate flavour, it is most likely to go wrong when the fermentation takes place from this particular germ.

7294. (*Professor Thorpe.*) I suppose you would not say that the bacteriology of cider manufacture was quite as —I think it is not quite.

7295. I suppose you are aware that it is now generally recognised that the reason why beer goes wrong in fermentation, or in its after-fermentation, is due to the presence of foreign organisms—what you call germs?—Yes.

7296. And that if care is taken to exclude those germs the evil to beer does not arise?—Yes.

7297. Perhaps you are aware that now a large number of the breweries make what they call pure cultures?—Yes.

7298. And that they can obtain these things commercially?—Yes.

7299. Using these pure cultures you know they find there is no necessity whatever to add any antiseptics or preservatives to the beer?—You can make a pure beer certainly from single-cell yeasts. I have some cider yeast that I got from Professor Jorgensen in tins five years ago, and it is living now, although he said it must be used immediately. I examined it about two months ago, and found it well preserved, but it is the after influences that are important.

7300. Let us do one thing at a time. Do you tell the Committee that the Copenhagen Institute is now in a position to supply the pure ferment culture required in cider manufacture?—No, I am not aware that it is. I sent some apple pulp to get some isolated pure yeast, and I made some isolated yeast myself; that from Copenhagen was not so successful when tested under the same conditions and influences as my own selection, and consequently I discarded the use of it.

7301. You have been able to identify an organism which is frequently concerned in the manufacture of cider then?—Yer, certainly—several.

7302. If you conduct the fermentation of cider with this pure single organism, would the subsequent effects that you have described take place?—They vary very much. Some cells—that is, some yeasts—are short-lived, and would die quickly, and if they die what becomes of the liquor.

7303. Do you mean to tell us then that it is not possible to get a pure culture in the case of cider manufacture in a manner similar to the case of beer?—You may get it, but unless suitable the yeast is made up to a certain gravity, under suitable conditions, and with the proper quantity of acid, and the same quantity of sugar, it is not likely to stand. Cider is not made as in a brewery, where you have one building, and all the temperatures can be made to vary, by cold and ice or cold air chambers, or cold or warm air. Cider is made in the open country in cellars, in which you get great variations in temperature. Therefore, the conditions are not the same.

7304. But the conditions could be at all events brought very largely under control, could not they?—They are largely under control, certainly; but these yeasts vary. Each apple produces a different yeast. I have been trying to find out why one apple should be sour and another should be sweet, and I think that might be found out. I consider that it is the germ in the wood that makes the difference. I have gone, as I told you, so far as to find out that germs are on the leaves. Where do they come from—from the buds or the sap originally? It has always been known hitherto that they exist on the skins of the apple, and I have proof now that they come from the leaves to the apple. Now, where do they come from to get on to the leaves—from the ground or the body of the tree? I consider they come from the body of the tree, brought up with the sap. If they do, there is something still to be said, and there is still further to go, because these germs are very different from one another. I have lots of different germs. Some will make a staple article, and others will not make a staple article. But we wish to make a palatable drink that the public would like. Some like one flavour and some another, and now we shall have to find out and discover the causes of the differences, and that is the work of time. These things cannot be found out in a short time—in one, two, three, or even more years. I have been at it now for 20 or 25 years, I might say; but we shall have to discover a strong yeast that, if used, will militate against what we may call this sickness. I think I may tell you I have three now out of the dozen that might do. I can scarcely speak from experience of its use, as I have only been at it two years, and two years is not sufficiently long to investigate it and show that it can be done. But if it could be done, we should very rarely resort to the use of preservatives. You know, in our old match-making process sulphur is used. Now we take out most of that sulphur after it has had its cleansing effect by applying boiled or baked apples; we put in a certain quantity two or three times, and that absorbs the sulphur compounds. The lees and the wood take out some of it. After it has had its cleansing effect there is very little left in the cider.

Mr. H. Symons.

8 May 1900.

7305. (*Dr. Bulstrode.*) Why do you limit the amount of preservatives in the cider?—Because, if there is an extra quantity used, it is useless. It might do the constitution of some people harm—I cannot say it would; but there is no use in it. I consider that if there is more than the proper quantity used, the manufacture has been faulty.

7306. What other preservatives besides salicylic acid, saccharin, sulphite of soda or lime are used? How much soda is used?—We should not use more than from an ounce to two ounces for a pipe.

7307. Do many manufacturers use more than that?—I do not know that they use any. Some do, I know, in America.

7308. You spoke just now of America. Do they use it much there?—Yes.

7309. How much do they use there?—They use about a third more.

7310. And in Germany?—I do not know what they use there. Of course, they use salicylic acid and saccharin largely.

7311. In what amounts?—They generally use about one-third more than I have recommended.

7312. Do you know the maximum amount of preservatives that has ever been used in cider?—No, I do not. I have never used at the very worst nearly as much as the Germans or Americans use.

7313. Are we to gather from your evidence that you do not think that a proper regard for cleanliness would prove a substitute for the use of preservatives?—No, I do not think it would. Certainly, cleanliness is of the utmost importance—it is a great thing. We use our racks and cloths, and a washing machine with two men to do nothing else than cleanse the plant and utensils, and we have special machinery for doing it, because it is absolutely necessary that the plant should be kept clean.

7314. (*Dr. Tunnicliffe.*) Are you aware of any work being done in this country upon the bacteriology of milk and cider upon the lines that are being adopted with regard to wine? I mean, is there any attempt being made to get the pure culture of the aroma-giving bacilli, and to add them after pasteurisation to the cider?—Yes; I myself have done it very often.

7315. With what success?—I have done it with varying success. Some bacilli, I tell you, will produce an unstable liquid, and that is owing, I consider, to the yeast, if the germs are delicate or short-lived, and others will produce a more stable article. They give different flavours. I have a score of different flavours, I suppose.

7316. Where do the aroma-producing bacteria of the cider come from? Where do they grow principally?—It has always been thought that they grow upon the skin of the apple. Last year I investigated the leaves, and I had separated several sorts of yeast from the leaves and the apple, and I thought to myself, "Where do they come from?" They were not only on the skin of the apple. I thought it was very interesting to see if there were any on the leaves, and I found there were different kinds on the leaves, and, as I say, I asked myself, "Where do they come from to exist on the leaves? Do they come from the tree, or do they come from the ground, or do they come from the air?" My impression is that they may come from the tree as spores, in the bud, in the sap, in the blossom. But that is a thing to be investigated.

7317. But if that were thoroughly investigated, you would have no need for preservatives, because you could exclude those viscosity-producing bacilli. That is the point I understand Professor Thorpe was trying to put to you?—Yes, I know; but it is very, very difficult to deal with. When you get a super-solution, which sweet cider is, having a gravity of about 10 to 12 pounds per barrel, and only with about 4 to 5 per cent. of spirit—say 3 to 4 per cent.—it is extremely difficult to preserve that; and people will have the cider sweet. We sell three sorts.

7318. When you see cider going wrong, do you add salicylic acid?—No; I would not do that. I would do it before if at all. We have forcing flasks and an incubator for forcing, to see whether it contains these particular germs, and if I thought there were any signs of it, or if there is a doubt about it, or if we think it is likely to be a warm summer, along with other considerations which I need not mention, we should act.

Mr. H. Symons.

8 May 1900.

7319. That is what I say; when you have indications that the cider is going wrong, whether by the gross senses or microscopically, you would add salicylic acid?—Yes; but I will not say we have indications. We examine it before the indications arise.

7320. But you must have indications in order to know it is going wrong?—You must have in the laboratory.

7321. I say microscopically?—Yes.

7322. And you add salicylic acid?—Not always.

7323. You add it as a preservative?—We often do.

7324. What do you say to pasteurising?—We have tried it ever so long since. I have pasteurised hundreds of hogsheads, but it does not work well.

7325. It is the means commonly adopted abroad, is not it?—It makes it very flat; it gives it a very insipid flavour. There is not much high-class light wine pasteurised now. It would not be used in this country, although it is used in France and Germany. The English will not drink what the French and Germans do.

7326. It is only the exception that you get these laboratory indications of cider going wrong?—Yes, it is the exception; we cannot always tell with certainty.

7327. Therefore you would require only to pasteurise cider exceptionally?—It would be too late to pasteurise it when it is quite ready for consumption like wine. The acidity in the cider would prevent it. You could pasteurise American or French cider with greater success than English cider on account of the greater acidity of English cider. It depends much on the soil it is grown on. Somerset is very different from Devonshire, and Hereford from Somerset. It is like the different breeds of cattle, for if you take a breed of cattle from one particular district and send it fifty miles away, it goes back, because the soil is not the same, and the conditions generally are not so favourable and the air is not so suitable. It is a breed of itself, which has grown up under certain conditions for a certain number of years, and it has attained perfection, and is found to be most suitable for that district. If you take a Devonshire Quarrenden apple it becomes different in colour if you send it to be grown in certain far distant localities. So you have to take all these things into consideration, and consider the situation. I do not advise, and I would not have it said that I advised the use of preservatives altogether for cider, because it would make people careless in the manufacture of it. But I say, do not prevent honest manufacturers from using a small proportion in case of necessity, because it is beneficial not only to themselves, but to the public, for if cider is sent out it is like beer; it is very largely consumed, and people are consuming a putrid thing sometimes. I will not say a putrid thing, but a thing analogous to that. It is like beer, and there were train loads of beer which went bad last year, and why, because very likely the makers had been depending too much on pure yeast and working too close to laboratory experiments which scientific men are sometimes apt to do, thinking the same result may be attained under different circumstances, sufficient allowance not being made for outside influences.

7328. (*Chairman.*) The cider industry is a very ancient industry, is it not?—Yes, very.

7329. But it is a progressive one—your knowledge in it is progressive?—I think so. Our trade keeps just the same as it did. We do not increase very much in that respect, for, of course, there is undoubtedly a great deal of competition.

7330. But I mean your knowledge of the manufacture has increased, and is increasing?—I think so, certainly.

7331. You have not attained perfection yet?—I cannot say. It is very difficult to say what is perfection now in these days. I think we have almost attained that as far as keeping quality goes. We do by far the largest trade, and I can consider it is by having such a knowledge of the business so many years ago that has enabled us to attain this position. I know the time when we lost thousands of pounds, but by looking at it more scientifically we have overcome that.

7332. Through your experience of the business, your knowledge of cider making has advanced?—Yes.

7333. Owing to the application of the results of bacteriological research?—Yes. I may say our forefathers used to drink cider in a very rough and acid state; but then they were living in the country, and taking plenty of exercise in the open air, so that their stomachs could stand it—they could do with that acidity.

7334. I was asking about the manufacture, and not about the consumption, and I repeat my question. During your experience, extending over 30 years about, I think you say the manufacture of cider has been very much improved. Is that so?—It is very difficult to say. I was reading a book dated 1828 the other day, and I thought to myself our forefathers were not fools. The writer recommended specific gravity of 1028 to 1033, which we find the best suited now for the public. So that in these early days there were some who understood their business.

7335. Then are you prepared to say that the only advantage acquired during your researches bacteriological and otherwise is of no use?—I would not say that for a moment, because I know a lot of my old men, my old hands, know what would produce certain results, but they do not know why, and in my case I was not satisfied before I found out why those results were obtained. I saw them there working at it all their lives, and knowing exactly the process, and what will produce certain results, and knowing which is the best process to use in order to get these results, but they cannot say why these results are produced, but I can tell why they are produced, and for a great many years I have known exactly from first to last both bacteriologically and chemically, why they are produced. Therefore, if science and practice agree, you cannot do better, I say. But you know the seasons vary, and the fruit varies, and the temperature varies, and therefore I say it is very, very difficult to tell what will be the result in a given case. I do not wish you to understand that I would advise the universal use of preservatives. I should certainly say they should be used under certain limits, and let these limits be small. If you allow too much alcohol the acid becomes too pronounced or apparent, which would not please the public taste, and I daresay the Government would not wish so much alcohol as that to be produced.

TWENTY-SIXTH DAY.

Monday, 14th May, 1900.

PRESENT:

The Right Hon. Sir HERBERT MAXWELL, BART., M.P., F.R.S. (*Chairman*).

Professor T. E. THORPE, F.R.S.
H. TIMBRELL BULSTRODE, Esq., M.D.
Professor TUNNICLIFFE, M.D.
CHARLES J. HUDDART, Esq., *Secretary*.

Dr. G. VIVIAN POORE, M.D., called; and Examined.

Dr. G. V. Poore, M.D.

14 May 1900.

7336. (*Chairman.*) You are a Fellow of the Royal College of Physicians and a Member of the Royal College of Surgeons?—Yes.

7337. You are physician to the University College Hospital?—Yes.

7338. Also Professor of Medical Jurisprudence and Clinical Medicine at the University College, London?—Yes.

7339. I believe you have directed some attention to the use of chemical preservatives in food?—I cannot say that exactly; my knowledge is that of a physician seeing the effects of food.

7340. Have you come to any opinion as to the possible effects of their indiscriminate use?—I think that it ought to be not permitted to add any preservative to food, unless the nature of the preservative an dthe quantity added be fully stated. I think that, besides the positive harmfulness of certain preservatives, the negative side of the question is most important; that there ought to be no risk of mistaking preserved food for fresh food; and that the want of fresh food cannot but have a very harmful effect on the health of the community—notably of children.

7341. Does that arise in your opinion from the action of these chemicals on the digestion, either directly or by retarding digestion?—I think it is impossible to say. I am making a plea, if I may put it in that way, for our ignorance on the matter. Scurvy is one of those things concerning which we are yet ignorant. I take scurvy in its broad sense. All that we know is that, when a community is kept with the absence of fresh food for a long time scurvy results, and the general level of health falls in many ways. No chemist and no physiologist has yet given us a satisfactory explanation of the cause of scurvy, which is a very great fact; all that we know is that if you keep a community on preserved foods too long it becomes scorbutic. It was thought at one time, as I need hardly remind you, that salt was the cause; but I think that is exploded. It was suggested at one time that if stock fish, that is to say, fish that were simply dried, were substituted for salt fish, that our sailors would escape scurvy; but that again was found to be not true. It is the absence of fresh food in some form, notably fresh vegetables, and to a less extent, fresh blood or absolutely fresh milk, that leads to scurvy; it is those things that are anti-scorbutic. It is the fact, I believe, that a child at the breast has never been known to contract scurvy. I do not know what may happen in a community severely stricken, like beseiged towns and so forth; but that I take it is a fact which I find stated everywhere, that a child at the breast does not contract scurvy.

7342. Do you draw any distinction between vegetables preserved aseptically and hermetically sealed, and vegetables preserved by the use of a chemical?—Yes. I should say that those preserved by chemicals might be positively harmful, according to the chemical used. Those simply preserved aseptically would have no positive harm, although they might have the negative quality of not being able to keep off scurvy.

7343. Is it not the case—it is a matter of popular belief, at all events—that preserved vegetables, bottled vegetables do prevent scurvy?—Yes, it is a matter of popular belief, but I think it has been found that preserved vegetables have failed; I think Nansen found that they failed. They have not the anti-scorbutic power of the actually fresh vegetable. It is well-known, of course, that the leguminous things—dried peas and beans—do not prevent scurvy, although of course drying the things is an antiseptic way of preserving; but that these leguminous plants, dried peas and beans, do not prevent scurvy, has, I think, been proved again and again. I should be very sorry to trust absolutely over a long voyage to preserved vegetables entirely, without some fresh meat, fresh blood, or absolutely fresh milk—I think there is a certain anti-scorbutic power in them.

7344. It is a fact, is it not, that there is a much greater immunity from scurvy generally, both at sea and on land, than there used to be?—Clearly; and that is due, first, to the great precautions that are taken, and then the voyages are not so long.

7345. Except when you go into the Arctic Circle?—Of course. Lime juice seems to be one of those things which retains its anti-scorbutic power for a long time; although occasionally it has been found that lime juice which has been doctored—I do not know with what, but with a preservative—has proved a bruised reed rather to lean upon for the prevention of scurvy.

7346. Then in your opinion the object that ought to be kept in view is the supply of food to large communities in an absolutely fresh condition?—Yes, certainly.

7347. And there is a distinct difference between fresh food—— ?—And stale food.

7348. And so-called fresh food, which is only kept fresh by means of a preservative?—I should say most certainly there is a difference.

7349. Again I will ask you to tell us anything that you think bears upon the question; I will let you take your own line?—With regard to milk which is a very important thing, if you add a preservative to milk which is perhaps tasteless, there is not only the harm done by the preservative to the milk itself, but it very soon ceases to be fresh milk. Of course the milk which is drawn by a suckling animal from the breast of its mother, which has never been exposed to the air, which has never been lowered in temperature, the constituent parts of which have never been allowed to separate, we must look upon, I think, as a different thing from milk which has been artificially cooled, exposed to the air, whether before or after sterilisation, and allowed to separate into its constituent elements. I do not think we can look upon those as the same things. Clearly it is the experience of all physicians and the experience of myself that children who have been fed in the natural way never manifest scurvy, and seldom manifest the rickety condition. It is when you get artificial feeding—and artificial feeding, of course, involves all those points I have raised, namely, the alteration of temperature, the exposure to air, and the separation of the elements—that you get those conditions. There are many adults who can take milk and cannot digest cream. That is a thing which has often come under my own notice, and it must make us pause in considering what the effect of separating the constituent of milk or allowing them to separate may be. What I am making is a plea for our ignorance that we do not go too much ahead of our facts and think that because a thing does not stink therefore it is fresh. There is a distinct difference in my mind.

Dr. G. V. Poore, M.D.

14 May 1900

7350. I am going to take you up on that observation that you think we must not go ahead of our facts. I see in the synopsis of your evidence that you imply that certain conclusions—you do not draw them, because you say you are unable to define them—may be drawn from the consumption by wild animals of warm meat?—All that I say about that is that it is a fact to make us pause; I do not wish to go further.

7351. Is it a fact, is it the case that animals that live on warm meat develop more energy than others?—They develop a very extraordinary energy, as you will have seen if you have watched, as I have, domestic animals—and I am quite sure you have. When, for instance, a cat is having a litter of kittens she shows an exceeding anxiety to get out and get live birds. The same thing with a bitch when she has a litter of puppies; I have noticed several times the exceeding anxiety of the animal to get out and get raw food. I cannot say more than that, and I did not mean to say more than that. It must make us pause. Really all that I am asking for in my evidence is that we do pause and consider how ignorant we are on these subjects.

7352. Is it not a fact that some animals who live indifferently upon fresh meat and carrion develop an equal amount of energy—the golden eagle, for example?—Does it live entirely on carrion? It takes fresh meat, does it not?

7353. Yes, indifferently—it takes fresh meat or carrion?—That may be. That is not quite the point. Of course I do not object to people taking high venison or rotten cheese or anything they like, but I think we all want a certain modicum of really fresh food. I think every animal wants a certain amount of really fresh food. Our horses are turned out to grass once a year so that they may get some really fresh food, and it is difficult to say on chemical grounds perhaps, what it is that a horse gets by being turned out to grass; but I think it is a generally accepted fact that it is necessary.

7354. I cannot accept that statement. I think if you ask any hunting man he will tell you that he regards the annual turning out of horses to grass as most pernicious to vigour. That old system is universally discarded now; I can speak as an old hunting man?—Of course I have no right to push that, but I travel about in the country and see horses taken out to grass, and I know that they are turned out when they are sent into the country. We see how exceedingly greedy a horse is after a little fresh food. See what a horse will do for a fresh carrot, for instance. Do you give your horses fresh carrots?

7355. Yes?—Perhaps the carrots may take the place of the grass. I do not say the grass is the best thing, but I take it that you, as a hunting man, always give your horses some carrots?

7356. Yes?—Very well then, the carrot, I think, takes the place of the grass.

7357. I do not want to labour the point, only I think it must be admitted, must it not, that some animals living exclusively upon carrion, such as the vulture, possess extraordinary powers of endurance and flight, with an enor-

Dr. G. V. Poore, M.D.

14 May 1900.

mous amount of animal energy?—What do you mean by carrion?

7358. What the vulture eats?—The vulture eats fresh meat, does it not? The vulture will come to the body however fresh it is.

7359. Its staple is carrion, because in the climate where the vulture feeds meat becomes carrion as soon as the life is out of it?—You are taking me out of anything of which I have special knowledge, but one reads, for instance, that in South America an animal dies and the condors are there, although they may not be seen at the time, within a few hours. I should take it that a body eaten within a few hours of death would have some anti-scorbutic property—would have some element of freshness in it.

7360. Possibly in this climate, but I do not think so in hot climates?—I do not know.

7361. I interrupted you. Will you kindly go on?—My statement to you is generally a plea that there ought to be no confusion between fresh food and stale food; and I go so far even as to include frozen meat in the category of food which is no longer fresh. We ought to know whether it has been kept a day or a month, or any length of time. Clearly my own experience is, and that of others is, that food preserved in that way loses its flavour. It all depends how long and carefully it has been done, but you do not always get the maximum amount of care with regard to temperature and so forth, and it is an undoubted fact that there is a great deal of frozen meat which loses its flavour and becomes flabby and generally unappetising. Of course, the great factor appetite must never be lost sight of; some things are appetising, some are not. A new-laid egg—I have taken that as an example—is appetising, and what the cook calls a shop egg to most of us is nasty; we do not care to eat it, although we get very little else in London. The same with butter; a really fine sample of fresh butter is an exquisite thing, beautiful in flavour, and intensely appetising; but I think we get very little of it in London. I should draw a very wide distinction between the two. I cannot say that one is poisonous and the other is not, because that is not true; and I do not want to be represented as saying that preserved foods of all kinds are not most necessary and are not most important articles of diet. I am only asking that there should be no confusion permitted between what is really fresh and what is preserved.

7362. In short, salt meat speaks for itself?—Yes.

7363. And these cryptic processes do not?—That is an excellent phrase—these cryptic processes do not speak for themselves.

7364. On the other hand, I suppose you would admit that certain changes go on in milk inimical to digestion or to the general health which are arrested or retarded by the use of these preservatives?—Of course, if the milk is prevented from going putrid that is a distinct advantage.

7365. Or if the multiplication of noxious germs is prevented?—Yes, I quite admit that. But there is another side to the question. Take milk that has been heated, semi-churned, run through tubes, and so forth; I cannot regard it as at all probable that that milk is the same as the milk drawn direct from the mammary gland of the mother into the mouth of the offspring, because in the latter case the milk drawn is really a living fluid; it has never undergone any exposure at all, and clearly it is as a rule very much more digestible for the child. There are cases where the child cannot feed from the mother, indigestion comes on, and we have to adopt artificial feeding, but those cases are exceedingly rare. When you come to the artificial feeding of a child, then the difficulties of digestion are exceedingly common, and you have to dilute the milk and alter the food and so forth. Then again there is the great danger of physicking a mother while she has got a child at her breast. If you give drugs to the mother or the wet-nurse the child is upset, notwithstanding the exceedingly small quantity of the noxious element which must be in the milk drawn from the breast. That again must make us pause, I think, as to the possible effect of preservatives or chemicals added.

7366. Now you have introduced a new element which has hitherto been advocated as an alternative to the use of preservatives. I understand you to be suspicious of the effect of pasteurisation?—No, I would not say suspicious. I think that is putting too strong a term on it. I do not think we ought to regard milk that has been withdrawn from the body as at all a substitute for milk withdrawn direct from the breast under any circumstances. As to what the effect of pasteurisation may be, nothing in this world is entirely for good nor entirely for evil, and I quite admit the advantage of sterilising milk; but there may possibly be another side to the question; it cannot be regarded as the same thing as fresh milk.

7367. If you have a declaration as to the presence of chemical preservatives, would you also on the same grounds require a declaration as to the pasteurisation of milk?—I would. It might increase the sale, although certain people might hesitate to use it exclusively, that is all. If milk had been pasteurised it ought to be so stated.

7368. Do you hold any opinions as to the use and possible effect of colouring matters of various kinds in food?—First of all, I cannot see why they should be used. Of course you have the very great danger that in place of the vegetable colouring, such as spinach and so forth, aniline colours may be used, and I should say they are all harmful—there is no question about that. It is a process anyhow not to be encouraged. I am told that colouring matters are added habitually to butter; I think really it ought to be stated.

7369. You are aware no doubt of the popular prejudice in favour of a uniform quality. A customer does not like his butter white one day and yellow the next?—That is so, but still he ought to learn that nature is never the same—she varies; and directly you get a thing of uniform quality the sensible man must know it has been doctored. Some years ago they advertised sherry of uniform quality year after year, quite irrespective of the alteration in the vintages, the climate, and so forth. That only appeals to me in one way—a uniformity of quality must very often mean that there has been some process adopted for making the quality uniform either in milk or in anything else.

7370. We have had a good deal of evidence about the use of sulphate of copper in the colouring of green peas?—That is perfectly indefensible.

7371. It has been urged that the quantity is so minute that it cannot hurt anybody. You do not believe that?—No, I do not.

7372. I may take it you would reject it in any quantity, however small?—In any quantity, just as I would lead, no matter how small.

7373. (*Dr. Bulstrode.*) Your evidence would rather amount in a sense to an attack upon our urban conditions, would it not? It would have a tendency that way?—Of course, our urban conditions make it so exceedingly difficult to get fresh food that it becomes exceedingly important that the people should be able to know when they are buying really fresh food, even though they had to give a much higher price for it.

7374. I suppose you will admit that, as we are at present tending, we must year by year, if the population goes on increasing, consume an increasing amount of preserved food of one or other kind?—Yes.

7375. And therefore it comes to be a question as to what is the best form of preservation, rather than a question of getting absolutely fresh provisions?—Of course, that goes without saying. I think that we want to find out the best mode of preservation. I say in my synopsis, and wish to repeat again, that preserved food must always have its legitimate place in all dietaries, and if the urban populations, as is evident, are getting more and more dependent upon preserved food, then I think it is very essential they should know where they can get fresh food.

7376. Your objections to the use of preserved food would to some extent be met by a due proportion of really fresh food, would they not?—Yes, clearly—a due proportion. But what that due proportion is I think we are not prepared to say yet.

7377. Would you advocate the labelling of every means of preserving?—Yes.

7378. Salt?—When it is necessary. You buy a ham and you know it is a ham, and know that it is preserved. That is a matter of common knowledge. We call a ham a ham and we call pork pork; but if you sell me a certain thing that is preserved as fresh pork then I think it ought to be stated.

7379. You do not quite know what the ham is preserved with, do you?—No, it is a matter of flavour very much.

7380. Would you advocate that where salt is used as a preservative that fact should be stated?—I do not see why it should not. Let it be stated that the article contains 5 per cent. of salt, or whatever it may be.

7381. And so with saltpetre, if there were any. Nitrate of potash in it—would you have that notified?—I think so.

7382. Suppose substances are preserved by smoking—such as kippered herrings and so forth?—If you buy a kipper you know what it means. "Kippered" is a label. All I am asking is a label. I do not want to be Quixotic in my demands.

7383. But we have to decide as to what is to be done, and the difficulty is are we to label smoked herrings, for instance? What is a smoked herring? What is the preservation due to?—It is due to the bodies in the smoke itself, I suppose.

7384. (*Chairman.*) Bodies in the smoke to which the herrings often are not exposed?—Quite so. A great deal of fraud goes on even in these matters.

7385. Are they not painted with pyroligneous acid?—I believe so. I believe there are all kinds of dodges.

7386. (*Dr. Bulstrode.*) Do you accept it that the preservation of those articles is due to traces of formic aldehyde?—I do not know.

7387. Supposing it were due to that, it would be necessary to label it, would it not?—Certainly.

7388. So with sugar. Would you label a thing which is preserved by sugar?—Yes, to be quite sure it was not preserved with saccharine or glycerine.

7389. Would you say so in the case of vinegar?—Yes, to be quite sure that it has not got sulphuric acid.

7390. You see no difficulties in carrying this labelling process out to its bitter end?—I do not.

7391. And so with milk and meat—you would label it all?—Certainly. I think it ought to be labelled. You ought to know when you are buying a frozen joint from an animal that was killed six months ago and when you are buying a really fresh joint from an animal that was fed on a farm at hand.

7392. Is it not a very relative matter? You buy a joint from an animal which was killed yesterday; that meat has been kept from decomposition by some means or other—either by cleanliness or by cold or by something else?—Yes.

7393. That will have to be labelled for you to carry out the thing to extremes, to be logical all through?—I do not think a man ought to be allowed to charge 11d. a pound for frozen mutton and sell it to you as fresh. I think that is a fraud, and personally I do not think it as good.

7394. You say in your synopsis "There can be no doubt that the fatality of infantile diseases (measles, whooping cough, tuberculosis, diarrhœa) is very largely dependent upon the state of the nutrition of the infant population." Do you mean by fatality the number of deaths?—Yes.

7395. The mortality?—Yes.

7396. Do you think that the state of nutrition has anything to do with the receptivity to infection?—Yes, I think it has everything to do with it. The state of nutrition has everything to do with the vulnerability or immunity of the animal. Look at the way dysentery was spread and other diseases in Ladysmith, for instance. You had there a population which was by force of circumstances starved—deprived of food of various kinds; and when you get disease breaking out in a population of that kind it spreads, and is much more fatal, and it spreads much more rapidly than it does amongst a well-nourished population.

7397. You think there is a correspondence between the receptivity to infection and the state of health?—Clearly. I think there is no doubt about that.

7398. Would you prohibit all aniline dyes?—In food.

7399. Yes?—No, not if they were advertised; *caveat emptor*, I would not buy them.

7400. With regard to copper in peas, have you considered the question of its solubility in the form in which it is administered in peas? What evidence would you adduce to show that in the form in which it exists in peas it is soluble in the human system. Supposing it is not soluble, it does not matter much, does it?—I cannot conceive that it is not soluble in the human system. Copper has been detected in the animal body by chemists, I believe, and it must have got there somehow.

7401. It is not universally accepted at the present moment that it is soluble?—Is it not the fact—I am asking you if you will kindly tell me—that copper has been found in the feathers of certain birds, and to such an extent that it has been detected chemically.

7402. (*Dr. Tunnicliffe.*) Yes, there is one instance in which it has been found in the colouring matter of the feathers of a bird whose food was free from copper?—And the copper was there.

Dr. G. V. Poore, M.D.

14 May 1900.

7403. Presumably?—It must have been soluble somehow? Sulphate of copper given in large quantities is an astringent, given in larger quantities it is an emetic, given in bigger quantities it will sometimes be a purge, and in larger quantities still it will be poisonous. I do not think it ought to be given.

7404. With regard to the question of copper in peas, would your view be modified when I tell you that it is impossible to eliminate copper from our diet?—Very well then, there is no occasion to add any.

7405. It is added to peas for the purpose of fixing the colour, of course?—Yes. It gives the pea a colour which never belongs to it. So I think. You can tell them at once, I think by the eye. It gives a colour which serves to me as a warning. When I get these peas at dinner I do not take them.

7406. With regard to the *a priori* probability of their being injurious to the consumer. Would the fact that it is impossible to eliminate copper from our diet in the same order of magnitude as is required to fix the colour of peas, in any way modify your view with regard to the probable effect?—Not a bit, because I cannot see any use in putting the copper in.

7407. That was not the point?—It would not modify my views.

7408. You still maintain that copper is injurious in any quantity whatever?—You are putting a question to me which cannot be answered. For instance, if you take a very minute quantity of lead it is not injurious. You might give me so many milligrammes of lead, and produce no result; but you know you cannot go on with it however small the quantity. I believe ultimately you produce lead-poisoning.

7409. The difference I suggest is, that we can eliminate lead from our diet, but we cannot eliminate copper; for instance, wheat contains copper, therefore the bread we eat contains copper?—If it is in the wheat, therefore we are getting quite enough copper in our diet without having any added to the peas. Presumably, if that is the case, copper may be of some necessity to our bodies, if it is always in our diet.

7410. In those circumstances do you think it would hurt us if we took 25 or 50 milligrammes more?—I cannot see any reason why it should be permitted without stating the fact; that is all. I only ask for the fact to be stated, that is all I plead for that the fact should be stated—"These peas contain so many milligrammes of copper." I do not care what it is, but it ought to be stated.

7411. You think that after stating it then, it would be *caveat emptor*?—Certainly, you state what the article is and then *caveat emptor*.

7412. I understand what you mean is you do not object to preservatives *quâ* preservatives?—Certainly not; preservatives which mean preserved food must always form a very important part of every national diet.

7413. But you regard the use of preservatives as being one of the factors which may deceive the consumer so that he gets stale food for fresh?—Quite so.

7414. And you think any undue proportion of stale food might increase scurvy?—Certainly.

7415. But you are not prepared to differentiate between the conditons in stale food that produce the scurvy?—No, certainly not.

7416. For instance, you canont differentiate between frozen food, or between preserved food or sterilised food or pasteurised food, and so forth?—No, I am putting in a plea for our acknowledged ignorance upon that subject.

7417. You are a well-known authority on hygienic matters?—Yes.

7418. It has been stated here that if preservatives were prohibited in milk the middleman would cease to exist, and there would be some difficulty in the big companies reaching the very poorest classes of the community—the people who want at odd times a halfpennyworth of milk in short—have you any view to offer upon that subject?—The only view I have to offer upon that subject is this. Take the Colonies, where space is easily obtained. When you are founding a city, to have a certain amount of pasture ground and market

Dr. G. V. Poore, M.D.

14 May 1900.

garden ground is of such obvious advantage in every way that it ought to be provided for by any municipality when laying out a city in a new country. That ought to be thought of. When you get your fresh food too far from your population it is a disadvantage all round. Of course, we have got to accept the conditions as they are.

7419. The conditions amongst the poorer classes—and you know them practically—are very bad for the keeping of milk, even for twelve hours?—Very bad. What happens to pasteurised milk after it has been kept in their filthy larders and places goodness knows.

7420. Do you see in the fact that milk very often goes bad amongst those poor people, one reason for the greatly increased use of conserved milks—tinned milks I mean by conserved milks?—Clearly I do see that, and it is a great thing to give people milk which is fairly wholesome; but I do draw a distinction between the milk as drawn direct from the breast of the animal and the milk which has been attended to in various ways, although I quite acknowledge, of course, the great advantage under our existing conditions of trying to find innocuous ways of preserving milk and all articles of diet.

7421. You think there is no absolute reason why a chemical method should not be an innocuous one?—No.

7422. No *à priori* reason that is?—No.

Sir L. Brunton.

Sir LAUDER BRUNTON, called; and Examined.

7423. (*Chairman.*) You are a Doctor of Medicine and Fellow of the Royal Society?—Yes.

7424. You appear here on behalf of the Royal College of Physicians?—Yes.

7425. Has your atention been directed to the use of chemical preservatives in food?—It has.

7426. To their prevalence and the possible consequences?—Yes.

7427. May I ask what general conclusions you have arrived at?—That it is almost imposible to prevent the use of preservatives, but that their use should be strictly regulated. If we do not use preservatives we run the risk of causing injury by food which is decomposing; but, on the other hand if we use preservatives in too large a quantity we may do harm through the preservatives themselves. Moreover it seems to me that by the unregulated use of preservatives we may possibly get a double danger—that from the drug itself which is used as a preservative, and that from the decomposing food which may, in spite of the addition of a certain quantity of the preservative still undergo change, and become dangerous to health.

7428. Taking as a type of perishable food the milk supply of a large town, do you think it possible to conduct it without the use of preservatives?—I do.

7429. Do you think it would be desirable to do so?—I think so.

7430. Is there the danger in the extensive use of preservatives at present known to be carried on, that in a delicate article like milk they may enable the vendor to dispense with such precautions as cleanliness?—There is.

7431. Have you formed any opinion as to the relative harmlessness or value of the different chemical preservatives?—I have formed an opinion, but the data upon which I have formed the opinion are so imperfect that I should prefer not to express any opinion. As will appear from the synopsis, I think that many more accurate data are required before an opinion of permanent value can be found. I have also given in the synopsis the way in which I think the data should be acquired.

7432. Would you kindly state it?—The data at present before us are imperfect. We are able to form opinions regarding the action of certain drugs from their administration either to animals or to men, but the length of time over which such experiments extend is too short to allow of a complete opinion being formed in regard to their action.

7433. Do I understand that you mean the cumulative action of such a drug would not be thoroughly ascertained?—The cumulative action, and possibly something more than the cumulative action, that is to say the continued action over a length of time, even though there should be no accumulation. To give an example of what I mean—if a man takes a little excess of sulphate of magnesia every morning, so as to cause rather too free purgation, there is no accumulation in the body of the sulphate of magnesia, but yet at the end of a year the continued excessive use of the drug has given rise to a condition of weakness which would not have been present but for this excessive use, and yet there has been no accumulation. I thus distinguish between the cumulative effect and a continued effect.

7434. To take the example of one common preservative—boracic acid; the amount of boracic acid which can be voided by the human subject in the course of 24 hours is limited, is it not?—It is limited, but I do not know the limit.

7435. That is one of the elements of uncertainty?—Yes, that is an element of uncertainty.

7436. Although you might know the exact quantity being taken by a human being, it would be impossible to know whether there was any accumulation going on?—It would be difficult to know whether any accumulation was going on, and with the present data before us, it would be impossible to say whether any continuous, as distinguished from a cumulative, effect was being produced.

7437. What steps, then, would you recommend with a view to regulating the use of these chemical preservatives?—I should recommend that, in the words of the Select Committee on Food Products Adulteration in their summary of principal recommendations No. 19: "An authority should be constituted who should act as a court of reference upon scientific and other questions arising under the Acts, and who should be empowered at their discretion to prescribe standards and limits of the quality and purity of food." The data at present before such a board would be imperfect, and in order to procure such data, I think that it would be necessary to insist upon the presence, nature, and proportion of preservatives in each article of food being notified by label or otherwise. By such notification in case of any symptoms arising in a consumer, it could at once be ascertained what amount of any given preservative he had been taking in the course of a day, and over what time this consumption had extended. By then comparing a number of such cases, one would be able to make out definitely what effect had been produced by any given preservative in given quantity in consumers of a certain age, sex, and strength.

7438. You would then put in the power of the consumer the option of purchasing a fresh or a preserved article?—I should assuredly.

7439. I am not quite sure whether you have specified the exact constitution of the board which you think desirable?—I did not; there were various recommendations before the Committee, and I did not form a definite opinion except with regard to one point, and that was that as this Board would have to do much more with questions of pharmacology, medicine, and public health than with questions of chemistry, I consider that the medical profession were rather insufficiently represented upon it under the proposals that I have found in the previous evidence, and that the Royal College of Physicians in particular as being one of the most important public bodies in medicine should be represented upon the Board.

7440. (*Professor Thorpe.*) That Board was originally suggested, I understand, by analysts?—Yes, I believe so.

7441. With a view of prescribing standards or limits, as they are now called, with respect to what shall determine adulteration in certain articles of food, and also with a view of prescribing methods of analyses which should be used in common by analysts who have to report upon the fact of adulteration. You have rather enlarged the scope of the Board, or rather you have altogether changed its character in your suggestion?—No, I have not changed its character, but I have enlarged its scope. One would require to have upon it analysts who were thoroughly competent to understand the chemistry but you would also require to have upon it someone who understood not only the chemistry but the working of the proposed preservatives upon the human body.

7442. Your suggested Board seems to me rather as sanctioning a vivisection experiment made by the public on themselves at their own cost?—No, I do not think so. There may be two opinions in regard to the utility of chicory in coffee; there are two very pronounced opinions, but I think that people should not be prevented from having chicory with their coffee, because I personally prefer the coffee without the chicory. I doubt very much if many of the preservatives in very small proportion would be any more harmful than the chicory, although I think that in excessive proportion they would be harmful.

7443. Then the object of your Board is practically to observe and to collect information respecting the action of preservatives?—The first process, of course, is to get definite information, and the next is to act upon it; at present we want the definite information. We can only act upon imperfect information, because we have not got the data. We can act to the best of our knowledge at present, limiting the quantity of preservatives in any article of diet, according to the best of our knowledge; but with the increased knowledge that we would acquire by observation we would then be able to issue definite rules, knowing then that we were right. At present the rules that we could issue would be such that we thought were right; later on they would be what we would know were right.

7444. You have already stated that in the case of milk you incline rather to the prohibition of preservatives?—I should be inclined, if possible, to carry on the milk trade without the addition of preservatives, and I think that it could possibly be done if the extension of the present methods of cooling were made absolutely compulsory. By the introduction of cooling, even into small shops, and by sterilising, it might be carried on without preservatives. But there also my information is to a certain extent defective, and I do not know how far it would be possible to carry on the sale of milk in the very poor districts of London without the addition of preservatives, nor whether by insisting upon the absence of preservatives entirely in milk one might not drive people simply to the use of preserved milk instead of the milk direct from the cow.

7445. Can you inform the Committee if there is any evidence that the use of sterilised milk is injurious to children—properly sterilised milk, and milk which is kept sterilised—I mean sterilised *per se*?—There, again, one falls upon the question of opinion versus fact; we have no sufficient data to form a definite opinion, but you will find various men taking the one side and others taking the other. I have heard it stated, apparently very definitely, that sterilised milk was exceedingly injurious to children. For my own part I do not think it is. The only point that I can see about it is that sterilised milk and boiled milk as a rule is not relished by children in the same way that fresh milk is, but as for definite knowledge upon the subject I have not got it.

7446. If it be the fact, as it has been represented to us, that at all events pasteurised milk can be obtained without any taint, or without any perceptible taste—is there any chemical change that you know of in the milk which would in any way render it injurious to children?—There is none that I know of, but I need not mention to Professor Thorpe, with his knowledge of organic chemistry, that very slight chemical changes in albuminous materials—changes utterly beyond the power of any chemist now to detect—convert an innocuous substance into a deadly poison. Between deadly poisons and their antidotes no chemist could detect the difference; I mean that the differences between serpent venom and non-poisonous albumoses are so slight that I do not suppose it is possible for any chemist to tell the difference between serpent venom and innocuous albumose. The only way in which the point would be settled would be by inoculation into a living animal.

7447. Is there any evidence that by raising milk, say, to the temperature of about 180 degrees Fahrenheit for a few minutes, there is any serious conversion of the albuminous matter in milk?—We have now got to the limit of our physiological knowledge. As you know perfectly well raising any fluid containing enzymes a very few degrees above a certain point would just make all the difference as to whether the enzymes remain active or not. Until we know more about the presence and action of enzymes in milk we cannot have any definite knowledge regarding the effect of sterilisation.

7448. I admit that it is thinkable; that it is conceivable; but I want to know whether from your own knowledge or observation any such change as the destruction of an enzyme, or the conversion of one form of proteid substance into another one—perhaps not a noxious form of the proteid substance—has been observed to take place?—Not to my knowledge.*

7449. (*Dr. Bulstrode.*) What would you regard as the least harmful method of preserving milk as far as your knowledge will allow you to state; I mean including sterilisation and the application of cold?—The application of cold is the best.

7450. You think that that would be the best means?—Yes.

7451. And the least harmful means of preserving milk?—The least harmful.

7452. Would you anticipate any bad results to milk from refrigeration, we will say?—No, none.

7453. You know of no facts which point in the direction that refrigerated milk may be harmful?—None.

7454. Is there a belief in the medical profession that refrigerated milk is harmful?—I do not think it is a general belief.

7455. Not so general perhaps as that sterilised milk is harmful?—I think not. But there I must guard myself for this reason, that although I have heard opinions expressed by individual members of the profession I have taken no census whatever of the profession to know the numbers.

7456. I rather gathered from your suggestions as to the constitution of this Board that you think this matter of preservatives an important one to the medical profession?—Assuredly.

7457. Of course you have thought of this matter in the light of drugs which are prescribed by medical men being used indiscriminately in certain foods?—Yes.

7458. Do you see in that a danger to proper medical treatment?—In the administration of certain of these preservatives there is a possible danger; I do not know how far it may be a certain danger. The possible danger is this: We know that certain drugs will counteract the effect of certain others, so that, for example, if you give an animal a lot of potash salts, and then administer barium the action of the barium is prevented—not entirely, but to a great extent.

7459. In that way the practice of the physician might be stultified?—Yes, but there again, as I say, we have not the data to work accurately upon.

7460. Let us take, for instance, a physician who goes into a hospital, and prescribes to a patient 10 or 15 grains of boracic acid three times a day; is it a matter of importance to the medical man, and to the patient, whether that patient may already be taking three times that amount?—Yes, I think it is.

7461. A serious matter?—I think so.

7462. And so with other drugs, such as salicylic acid and benzoic acid, and other preservatives?—Yes.

7463. There is one question I should like to get the advantage of your opinion upon now, and that is the contra-indications for the administration of certain drugs, more particularly borax and salicylic acid. If I may read you an extract from your work perhaps you would kindly give us your opinion upon it—this is in reference to borax: "It has been supposed to have a special action upon the uterus, and has been employed in amenorrhœa, dysmenorrhœa, and puerperal fever and convulsions. On account of its asserted power to increase the uterine contraction it ought either to be avoided or employed with great care during pregnancy." If that statement is the fact, is there not a danger that a very large number of child-bearing women may be at this time taking something which, according to this statement, is contra-indicated?—There is a certain danger of that.

7464. Then with regard to the use of salicylic acid, may I just read you this: "Sometimes, however, the salicyl compounds so irritate the kidney as to cause albuminuria, and even hæmaturia; and they must be used with great caution when given for this or other purposes if renal or hepatic disease be present, and in aged persons inasmuch as under their influence there is an increase of the amount of uric acid waste, and they are apparently not diuretic. The salicylates are believed by some authorities to be harmful in gout." Assuming that again to be true, do you see in that an objection to the indiscriminate use of salicylic acid?—To the indiscriminate use certainly; and

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*This answer refers to the effect of raising milk to 180 degrees Fahr. for a few minutes and not to the effect of prolonged boiling, which causes coagulation of some of the albuminous constituents with the formation of a scum on the surface.—L. B.

Sir L. Brunton.

14 May 1900.

that I think affords a very strong proof of the correctness of my suggestion that preservatives should not be allowed to be used without the person who is using them knowing that he was taking them, because in the great majority of cases salicylic acid will not produce those symptoms, but there are certain individuals who might be thus affected. If salicylic acid is allowed to be used without its use being notified to the consumer, he may be suffering from those symptoms, while he himself and his medical man are totally in the dark in regard to the cause of the symptoms, whereas if it is notified that the milk or other food which he is taking contains a certain proportion of salicylic acid the attention of the medical man would probably be at once directed to the possibility of salicylic acid having been the cause of the symptoms.

7465. Do you think it eminently desirable that the milk supply to all hospitals should be examined for preservatives?—Yes, I do.

7466. (*Dr. Tunnicliffe.*) I take it what you mean in regard to this Board is that this present Committee is hardly in a position to get sufficient data to form an opinion upon so important a matter?—That is so.

7467. And that, even supposing such a Board were appointed, the appointment of that Board might lead eventually to the prohibition of preservatives?—It might.

7468. Would you give to the Committee your opinion with regard to the probable injuriousness of very small doses of copper, as an instance 25 to 50 milligrammes twice a week?—That question, I believe, has been very thoroughly worked out; the presence of a minute dose of copper is quite innocuous.

7469. (*Chairman.*) That being your opinion on the use of copper, would you object to its employment as a colouring matter without declaration?—Certainly, because although the presence of that copper in that proportion might be innocuous, I think that the principle of allowing anything of the sort to be used without declaration is most objectionable. But it has been said, I believe, as an objection to the declaration, that it would interfere with trade, and that it would interfere with various things being sold. It seems to me that it would not do so in the very least; all that would be necessary would be that each article should bear a label stating that it contains such and such a preservative in the proportion licensed or approved of by the Board or Committee which is proposed to be constituted; people would then take the article of food readily enough, and there would be no interference with the trade, and there would be a great security for the consumer.

7470. Is there not a practical difficulty in declaring the proportion of the drug or colouring matter used, inasmuch as a quantitative analysis is a troublesome thing to undertake, and also that there may be a different proportion of the substance in one part of the consignment to another?—There ought not to be.

7471. Is that not very much the character of the substance we have mentioned last, sulphate of copper; is it not apt to collect more in one portion of a parcel than in another?—It may; but that could easily be stopped in this way: if it were found to have collected in a larger proportion in one part than in the other, and exceeded in one part the proportion allowed by the Board or Committee, the manufacturer should be held liable. He ought to have taken greater care to distribute his copper throughout the peas.

7472. We are talking of a practical difficulty; take our friend opposite, Fortnum and Mason, he does not manufacture, he imports from abroad; would you hold him responsible for an excess of copper in a bottle of peas?—Certainly; he would then come back upon the manufacturer, and the manufacturer next time would take good care that the peas were up to sample.

Mr. F. Womack.

Mr. FREDERICK WOMACK, called; and Examined.

7473. (*Chairman.*) You are Bachelor of Science, Bachelor of Medicine, and Lecturer on Physics at St. Bartholomew's Hospital and Bedford College, I think?—Yes.

7474. You have directed some attention to the effects of some of the modern chemical preservatives upon the consumer?—Personally I have not had my attention directed to very many cases on my own account—I have come across them rather by way of accident, but I know of a few instances where preservatives in milk particularly have caused some little derangement.

7475. Could you describe them to the Committee?—Two instances occurred in a family living at Ealing, where the preservative was boracic acid added to milk. In both father and daughter there was a considerable amount of digestive interference set up caused by the presence of a comparatively small amount of boracic acid in the milk.

7476. Was it undoubtedly traced to that?—I think it was undoubtedly that, because as soon as they changed their supply the symptoms practically disappeared. I myself tested the milk, and found that boracic acid was present in it.

7477. Do you know in what proportion the boracic acid was present?—No, I am afraid I cannot tell you now; it was a small quantity only.

7478. Is the opinion you have formed unfavourable to the use of these preservatives?—No, I cannot say personally that it is in general, though there are just a few cases which I have lighted on of that character where they seem to have been the cause of some derangement. I cannot say that I have any strong feeling against the use of boracic acid or some other preservatives.

7479. Should it be put under any regulation?—I think if possible it would certainly be desirable to have regulations governing the use of any such bodies.

7480. (*Dr. Bulstrode.*) As a physician, do you see any objection to the indiscriminate use of drugs which are used in practice?—I am afraid I ought not to accept your first suggestion "as a physician," because I am not one. I have only qualified as a physician, and I have never done any practising in medicine. I have devoted myself to physical science entirely.

7481. Lecturer on physics is your correct designation?—Yes.

7482. In what capacity may we ask your opinion?—I take it that I was chosen by the Committee of the School to attend a meeting of the Committee here. I cannot tell the reason why they made the selection. Possibly it was because I am associated with the toxicological examinations for the County Council; that is the only chemical work that latterly I have kept in touch with.

7483. Can you tell us anything as to the action of formalin in milk?—Physiologically?

7484. Yes?—No, I am afraid I cannot give you anything from my own experience.

7485. Do you see any danger in the indiscriminate use of a substance like formalin?—My own personal opinion is that it would be highly objectionable.

7486. For what reasons?—I think it would interfere with the formation of enzymes and the bacteria which are associated with the proper digestion of milk and other foods. I think if it acts antiseptically in one direction it probably will equally act as a bactericide in others.

7487. Looking at the varying effects of different antiseptics and disinfectants, does it necessarily follow that the destruction of certain bacteria means the destruction of all bacteria?—No, I think not.

7488. It would be possible that any given substance might act as an absolute disinfectant to certain bacteria and might have no detectable effect upon others, would it not?—Yes, certainly, I think so.

7489. Do you think a substance like formalin might act upon the secreting powers of the cells?—I should think it certainly might if it were present in anything more than a minute quantity.

7490. Do you know anything as to the hardening effect of formalin upon the animal tissues?—Yes, certainly. Of course, I am speaking now generally; it would depend very much upon the proportion a person used as a preservative.

7491. You think if it is used at all it should be limited?—Certainly.

7492. You speak in your proof of the "ill-effects on digestion from inhibition of large doses of boracic acid given medicinally," and you refer there to Dr. Church. What are we to understand by that?—Dr. Church particularly gave me an instance of cases in the wards where he had had occasion to give boracic acid in large quantity, and where he had found that it caused considerable

Mr. F. Womack.

14 May 1900.

derangement of the digestive processes. He implied in his letter to me, which I shall be very happy to show to the Committee if they care to see it, that in small quantities he has not observed any injurious effect.

7493. (*Chairman.*) You appear on behalf of St. Bartholomew's Hospital?—Yes.

7494. (*Dr. Bulstrode.*) Could you give us the amount in the cases in which it produces bad results?—Dr. Church said it was given in 15 grain doses.

7495. To an adult?—He does not definitely say, but there is no doubt that he implies an adult.

7496. Was it an adult in health, or what would it be given for?—That he did not say.

7497. In how many cases did this occur?—I will read the letter. The letter is dated the 5th of May, and he says: "I have nothing to communicate with regard to boracic acid or formaldehyde. The former I have not infrequently used as a medicine internally, and on one or two occasions large quantities have produced unpleasant symptoms, upsetting the digestion, and causing distate for food, but the quantities were far in excess of anything that would be suggested as a food preservative. If I remember rightly the symptoms resulted from 15 grain doses every four or six hours."

7498. Are you aware that as much as 80 grains of boracic acid have been found in a pint of milk?—No, certainly not.

7499. That would rather modify Dr. Church's opinion, would it not?—Yes.

7500. Then you mention the objection to formalin in milk and butter in connection with the names of Mr. Lockwood, Mr. Vernon, and the majority of the medical staff; would you just amplify that?—In most of the cases the letters I have received merely state that they have not any definite evidence to proffer to the Committee, but that they have themselves a feeling of objection to the presence of these bodies in either milk or butter.

7501. But they furnish no evidence in support of their views?—No, they gave me no clinical evidence at all.

7502. You also state on your proof that there is no clinical evidence of the effects of small doses, and you quote Dr. Champneys, Mr. Bruce Clarke, and the majority of the staff; would you explain exactly what that points to?—They merely stated in their letters that they could not give me any definitive cases that had come under their own observation in the wards as to any ill results following from the presence of small doses of preservatives.

7503. Did they tell you what good results had followed the effects of such small doses?—No.

7504. From the evidence which you put before us may we gather that the staff referred to are rather hostile to the use of preservatives?—Yes, that was the general feeling, undoubtedly.

7505. Was it also the feeling that there was an objection to the use of milk preserved by drugs; in hospital practice many of those things such as boracic acid and salicylic acid are drugs prescribed to patients; did they feel that their indiscriminate presence in a food like milk ought to be regulated?—That was certainly the general feeling; one or two wrote quite strongly from that point of view.

7506. Could you give us an instance?—Mr. Lockwood writes to that effect. He says: "I should have thought that the authorities would know their business better than not to have the supplies properly looked after." He is astonished that milk or butter should be sold containing any trace of preservatives at all.

7507. (*Professor Thorpe.*) That is not so much regulation as absolute prohibition?—It is absolute prohibition from his point of view, certainly.

7508. (*Dr. Bulstrode.*) Are there any other letters which you think the Committee would be glad to have on their minutes?—I am afraid they are all of that negative character; they are not prepared to state clinical evidence, but they for the most part state that they feel there is an objection to the presence of those bodies in food stuffs.

7509. (*Dr. Tunnicliffe.*) Have you got any opinions to offer with regard to the presence of colouring matters either on your own part or on the part of St. Bartholomew's?—No, I have not anything to offer at all, I am afraid, about that.

7510. For instance, would you like to say anything upon the subject of the presence of copper in peas?—My own personal view is that the presence of copper in any quantity whatever is liable to be highly deleterious.

7511. Irrespective of the way in which copper is present, for instance, as an insoluble compound in the case of the pea?—Yes. I am not prepared to modify my opinion because of the insolubility.

7512. If it can be shown that a large amount of the quantity ingested was eliminated in the fæces, would you still hold the opinion that it might cause an ill effect?—Yes, unless it can be shown that it was wholly eliminated, I should object to its being used.

7513. The Committee have heard a good deal from the witnesses with regard to the hardening power of formic aldehyde upon proteid material; could you give the Committee any information with regard to the characteristics of the actual compound formed between formic aldehyde and proteid; I mean as to the molecular proportion?—I am afraid I cannot from my own knowledge.

7514. It is the fact, is it not, that in the case of these hardening instances the formic aldehyde is used in a very much larger proportion than in the case of its employment as a preservative?—Yes, certainly.

7515. Do you know about how much is the average quantity of formic aldehyde used to harden a proteid?—No, I am afraid I have not actually personally used it. I only know about it second hand as to its employment as a hardening agent.

7516. Do you think it follows *a priori*, that because formic aldehyde is a hardening agent that the compound formed with proteids by it will be indigestible?—You have no *a posteriori* evidence to offer, so I ask you for your *a priori* view?—Yes, I think it does.

7517. Would you expect that formic aldehyde would render milk more indigestible by virtue of the fact that it would form with casein, a relatively indigestible compound?—Yes.

7518. For *a priori* reasons?—Yes.

7519. Therefore you would object to its use in any quantity whatever in milk?—I am not prepared perhaps to go quite so far as that, but I certainly think its use should be very largely under restriction.

7520. How would you purpose to restrict its use?—I am afraid that there I cannot give you a very definite answer on account of the difficulty of determining the quantity of it present.

7521. The same difficulty would apply to boracic acid, would it not?—Yes.

7522. And to salicylic acid?—Yes.

7523. As far as you have been able to collect actual clinical evidence, it is what you might call very indecisive upon this question?—Yes.

7524. In fact no evil results, or practically none, have been noticed at a large hospital?—No.

Professor W. D. HALLIBURTON, M.D., F.R.S., etc., called; and Examined.

Prof. W. D. Halliburton, M.D., F.R.S., etc.

7525. (*Chairman.*) You are Professor of Physiology in King's College, London, and Fellow of the Royal College of Physicians?—Yes.

7526. I understand your attention has been directed to some of the effects of modern chemical preservatives?—Yes. May I say first that I come here at the request of the Royal College of Surgeons. I have been nominated with Professor Starling; I think he gave evidence last week. I sent in, I am afraid, a rather lengthy synopsis of some of the observations and experiments that I have made.

7527. I have it, and I will let you take your own way through it?—May I just, as it were, summarise, and that will, of course, leave you, as you like, at your leisure to go into the details that I have presented.

7528. Would you, please?—I would say at the outset that the kind of evidence that I have to offer is not very largely clinical. The amount of medical practice which I have seen is limited. Very soon after my student days I took to physiological work, and I have remained at that more or less ever since; so that the actual observations that I have to make are in the nature of physiological ex-

Prof. W. D. Halliburton, M.D., F.R.S., etc.

14 May 1900.

periments, and deal principally with the two chief substances that you have under investigation, as I understand —compounds of boron and formaldehyde. On general principles one would object to the continuous use of antiseptics. The substance which would destroy the life of micro-organisms could not be expected to be beneficial to the life of a higher organism; it would be largely a matter of dose; I mean to say the same dose that would kill a bacterium would not necessarily kill a man, but still it would be hostile to the protoplasmic actions that constitute the life even of a high animal like man.

7529. It is not inseparable from antiseptics that they should be injurious to digestion. I think—it does not follow?—You are thinking of such a substance as common salt perhaps?

7530. Yes?—That is a normal constituent of the body. There have been cases recorded where the immoderate use even of such a normal article of diet has been injurious. It is very largely a matter of degree all through. Of course, a typical instance is in the use of sulphur. If a man were to stay in a room while it is being fumigated by sulphur he, as well as the micro-organisms, would suffer. Even in such a simple process as the process of cooking—the commonest method of destroying micro-organisms—there are some disadvantages. These are disadvantages which the most of us can cope with, but still to a person with feeble digestion, over-cooked meat, and hard-boiled eggs are almost proverbially indigestible. Of course, one always has to weigh in the case of cooking the disadvantages against the advantages; and so with antiseptics it is always a question which is the more advantageous to put up with, the products of putrefaction or the antiseptic which has been used to prevent putrefaction. So far as I can say, on the whole, if it were possible it would be better to prohibit the admixture of foods and foreign substances, and substitute for it the wholesale use of a method of cold storage and transport.

7531. Cold storage has a deteriorating effect upon animal substances, has it not—for instance, meat?—You mean to say that New Zealand mutton is not so nice.

7532. That is an extreme instance. But if you put a partridge into cold storage in December and took it out in June you will not find it so palatable?—No; a partridge is an instance the other way, because that is a form of food which we have been taught to like in a somewhat putrid condition. The flavour of a partridge is by epicures, I suppose, not considered right unless a certain amount of putrefaction has taken place. In the case of milk coming from the country there could not be anything like the length of time as there is in meat coming from New Zealand, and I should say, under those circumstances, there could be no deteriorating effect produced. One reason, I fancy, of the difference of opinion that has been so freely expressed with regard to the use of antiseptics is the idiosyncrasy of individuals. Some people are so more readily susceptible to the use of certain drugs—take salicylic acid, for instance—than others are. If the Committee do not see their way to recommend the absolute prohibition of antiseptic materials I would suggest that where they are used a label or something of that sort should indicate what has been used, so that people who are particularly susceptible to, say, borax or salicylic acid, should know what there is in this can of milk, or what there is in that cart load of meat, so that they may avoid it.

7533. People should no longer be permitted to sell as fresh milk milk containing a preservative, taking milk as a type?—Yes, that is so, and that if milk has a preservative in it it should be so indicated. I do not think I need dwell upon the paragraphs under the head of "salicylic acid," "benzoic acid," "carbolic acid and corrosive sublimate," or "metallic admixture." They are merely brief statements mainly gathered from others.

7534. What do you refer to under that head of "metallic admixtures"?—That relates to copper, particularly.

7535. For colouring purposes?—Yes. And not only that—there is a good deal of copper and tin, too, in canned foods, which are not necessarily coloured by the copper.

7536. Sometimes to a dangerous extent, is it not?—Yes, there have been some cases recorded by German writers. I have noted down the name of one who has done a great deal of work at it—K. B. Lehmann. He states that in an ordinary German diet there are about 20 milligrammes of copper daily, and if preserves are much used it may rise to 300 milligrammes a day. He considers more than 120 milligrammes in a day is harmful.

7537. The presence of this copper is accidental, not intentional?—Yes.

7538. It arises from an accidental effect in the mechanism of preservation?—Yes. I am afraid I do not know very much about colouring matter added to milk except in the case of one child—the baby of a friend of mine—who suffered from dyspepsia, and it disappeared when their milkman was persuaded to give them uncoloured milk.

7539. What did he use?—I do not know what the pigment was. I could not ascertain. As a general principle, I should say it is best to avoid the use of artificial dyes, which are quite unnecessary, and the public should be taught that rich milk and rich butter need not necessarily have a bright yellowy tint.

7540. You are aware how arbitrary is the taste of the public in these matters?—Yes, I know.

7541. Then, as to boric acid, you have made extensive experiments?—With borax and borates I have made a fair number of experiments. In the introduction I allude to what is known as "borism." The eruption occurs on the skin of certain individuals as the result of the use of either boric acid or borax. There have been other cases recorded—although here again I cannot speak personally—in which dyspeptic troubles have arisen. There have been a fair number of experiments performed upon animals.

7542. Does it amount to a strong opinion that you have that the use of borax as a preservative in food should be notified?—Yes.

7543. You think it is important to the public generally?—Yes, to the public generally; especially borax more so than boric acid. Borax is much more readily soluble, and they get much more of it.

7544. Boric acid is the commoner preservative, is it not?—I am not so sure. I think very largely a mixture is used that is called glacialin—a mixture of borax and boric acid. In animals the chief advantage—if one may put it so—of the poison is that it is not cumulative; it does not accumulate in the body, but it is rapidly eliminated by the urine.

7545. Up to a certain maximum?—Yes. I should say that the continual passage of a foreign substance through the kidney cells cannot be likely to do them any good. Some years ago Professor Allen, of Birmingham, formerly Professor of Physiology at the Mason College there, drew my attention to cases of malnutrition in infants fed on milk treated with borax. On examining the matter Professor Allen found that borax prevents the normal action of rennet. In milk digestion there are two ferments that come into play; there is the curdling action of rennet, which acts first of all, and then there is the subsequent solvent action of pepsin. It appears to be necessary for the proper peptonisation by means of pepsin that there should be this preliminary breaking down of the proteid molecule in the milk, which is evidenced by the formation of a curd. I have repeated those experiments, and found that Professor Allen is perfectly right. I could not find that there was any hindering influence when boric acid was employed, but I found that there was a very distinct hindering influence when even minute doses of borax were used in the milk. For instance, in one experiment I found that one decigramme of borax added to 100 cubic centimètres of milk entirely prevented the curdling action of rennet.

7546. For an indefinite time?—It was watched for 24 hours, and I threw it away then. That is an instance of a fair number of experiments that I have done. The milk kept good all the time. In a specimen to which a similar quantity of boric acid had been added the milk did not keep good.

7547. What where the conditions of temperature?—The temperature of the body 37 degrees Centigrade, 99 degrees Fahrenheit.

7548. The inference, then, is that the digestibility of the milk was seriously interfered with?—Yes. I should say, to summarise, that of the two—boric acid and borax —borax is the more efficient antiseptic, and it is also more harmful to the soluble enzymes which act upon the milk during digestion. With regard to formaldehyde, I should say that that substance should be absolutely prohibited. It is an extremely efficient antiseptic—a marvellous antiseptic—but it acts also in quite small doses on the unorganised ferments, or the enzymes, and I have in my synopsis presented experiments which prove this with regard to the gastric digestion of albumen, the pancreatic digestion of albumen, the pancreatic action upon starch, and the action of the rennet upon milk. I have taken those as four typical digestive enzymes. The amount of formaldehyde which produces deleterious effects upon digestion is surprisingly small. May I call your attention in particular to the experiments upon the pancreatic juice, which is headed "Influence of Formaldehyde on the Pancreatic Digestion of Proteid." The pancreatic juice is the most potent of all our digestive juices. Some fresh fibrin was taken and submitted—these were all equal weighed quantities—to the action of artificial pancreatic juice, and digestion was completed—that is to say, all solid fragments had disappeared—in thirty minutes. The fibrin, which had been placed previously in a solution containing five parts in 10,000 of formaldehyde, took more than three times as long to digest; and with the fibrin which had been placed in double that strength one part in 1,000, or in a strength greater than that, there was no trace of digestion even at the end of twenty-four hours. The hardening influence is remarkable also. Even these minute doses of five parts in 10,000 and one part in 1,000 produce extreme hardening, and I imagine that some of the lack of digestion is due to that as well as to the influence which the drug has upon the ferments contained in the digestive juices.

7549. (*Professor Thorpe.*) You say in your proof that you incline to the belief that certain obscure conditions of ill-health might sometimes be traced to the use of antiseptics. Would you kindly tell the Committee more in detail upon what you base that opinion?—Upon the cases I see recorded from time to time in the medical journals. I believe Dr. Anderson gave evidence here within the last few days; he has from time to time in the *Lancet* described cases in which dyspeptic troubles which he has noticed in his patients have passed off after having ceased the use of food containing borax. As I said before, the number of actual patients that I see myself is extremely limited, as I am not in actual medical practice.

7550. I gather from what you have told the Committee that you would prohibit the use of formaldehyde altogether?—Yes.

7551. You would equally prohibit the use of salicylic acid?—Yes. Salicylic acid I should consider an extremely dangerous drug.

7552. Even more dangerous than formaldehyde?—It is dangerous in a different way. It is not such an extremely hardening agent, and apparently it is not so hostile to the influence of enzymes in the alimentary canal; but its danger arises from the mental symptoms, which in some people even small doses will give rise to—excitement, delirium—maniacal symptoms even in some cases.

7553. Even in such doses as are likely to be found by using it as an antiseptic in food?—I should hardly expect to get maniacal excitement in such cases, but I should anticipate that even such small doses as are found in food would produce the nervous and mental excitement which are a mild degree of this mania.

7554. Have you anything to tell the Committee with respect to the use of colouring matters—to begin with copper; do you consider that copper may be introduced, for example, into peas without any hurtful effect?—It all depends on the quantity.

7555. Would you, in fact, palliate the use of copper in peas—that is what I rather want to get at—would you condone it?—No, I should condemn it.

7556. On what grounds would you condemn it?—On general principles, first that it is a foreign substance; that, even although a considerable quantity may pass into the fæces, the acid of the gastric juice may cause a certain amount of solution, and therefore a passage into the cells of the body of the copper; and that foreign substances, especially metallic admixtures, become cumulative, and are not readily eliminated. Of course, I know that in some animals there are normal copper-containing substances, but that is not so for mammalian animals—there is no normal copper-containing constituent of the body with them. In crabs and lobsters and in the plantain-eating birds there are substances which normally contain copper. The blue pigment of the crab is a copper-containing substance, and the red colour of those birds, the touracans, is a copper-containing substance; but those are entirely exceptional things in the whole animal kingdom. There is no copper-containing substance normally in the human body.

7557. I gather you would be inclined to prohibit the use of copper in a substance like peas or similar vegetables?—Yes, even although a certain number of people may eat them without experiencing any harm, just as we are all breathing every day tubercle bacilli and not getting tubercle.

7558. You say you are aware of Liebreich's pamphlet on the action of borax?—Yes.

7559. Have you any opinion or remarks to make upon that that you would like to bring to the notice of the Committee?—Not further than what I have put in my own synopsis. It appears to me to be rather the position of an advocate that he takes than putting down the thing from the absolutely impartial point of view.

7560. It struck you on reading the pamphlet that the evidence was rather biassed?—Yes, I thought it was rather biassed.

7561. You say in your synopsis that Professor Liebreich in a letter to the *British Medical Journal* has practically admitted that his writing was from the point of view of an expert retained for the defence?—It struck me so from reading the letter.

7562. (*Dr. Bulstrode.*) With regard to those experiments of Liebreich, could you tell the Committee in what manner you thought they exhibited evidences of bias?—I do not know that I am prepared to stand an examination upon the details of the paper.

7563. Could you criticise destructively for our benefit any of the experiments which he made?—It was more in his general conclusions that it struck me where the bias came in, saying that the substance was absolutely harmless, in spite of the fact that he admits the occasional occurrence of borism.

7564. In large doses?—Yes, he mentions large doses. I do not think he has taken sufficient notice of the cases that have been recorded where much smaller doses have been able to produce the effects.

7565. Do you think one can deduce much as to what may happen in the human economy from that which takes place in that of a dog?—With certain allowances, yes; but I should say that on the whole the dog was a more resistant animal.

7566. More resistant?—Yes, it has, so far as the alimentary canal is concerned, a much stronger series of juices; it has been shown in dogs that you can give them quantities of corrosive sublimate and of iodoform, and completely sterilise their alimentary canal—quantities which it would be absolutely fatal to give to a man.

7567. Do you think it is fair to argue on what might happen to a puppy from that which happens to an adult dog?—Do you mean if I did experiments on a puppy should I apply them to the adult dog?

7568. Would you infer that that which happened in a dog would happen to a puppy?—The puppy takes more milk. It has a different kind of food to the adult dog, but, on the whole, the metabolic processes in the young animal and in the old one are much the same.

7569. Do you know anything of the experiments of Dr. Annett and Professor Boyce, of Liverpool, in reference to kittens?—No, I do not know those.

7570. Do you know they experimented with boric acid?—That had escaped me; I did not know that.

7571. With regard to the effects of salicylic acid in producing a certain disturbance, do you know if that has decreased lately owing to pure salicylic acid being used?—That I do not know; I see very little hospital practice now.

7572. May we take it, then, that in your view you are absolutely opposed to the use of formalin?—Yes.

7573. And that with regard to the other preservatives, if they were labelled that would meet your objection; is that your position generally?—No, I feel that the ideal condition of things would be to prohibit them all.

7575. All preservatives?—All preservatives.

7575. Even salt?—No; I am not speaking of substances which are normal constituents of the body.

7576. Would you prohibit nitrate of potash, too?—Yes. One knows, even from smoking cigarettes, that nitrate of potash is not absolutely harmless.

7577. You would prohibit all preservatives which are not discovered in the normal body?—Yes.

7578. Would that not be rather difficult to carry out—I mean to classify properly?—That is what I say. It is difficult, but still it is the ideal condition of things, and as much as possible, therefore, their use should be prohibited, and cold storage or cold transport substituted

Prof. W. D. Halliburton
M.D., F.R.S.,
etc.

14 May 1900.

Prof. W. D. Halliburton, M.D., F.R.S., etc.

14 May 1900.

for it. But of the preservatives I would say that boracic acid is the least harmful and probably the least efficient.

7579. Less harmful than salt?—I am not including salt. I am speaking only of foreign admixtures. Salt is a normal constituent of food, and a normal constituent of the body.

7580. Could you tell the Committee anything as to whether the use of sterilised milk is prejudicial, or is likely to be prejudicial, to the health of an infant taking it?—I have only heard that such statements have been made, and they have astonished me.

7581. As a physiologist can you say anything upon that?—As a physiologist they have astonished me. Of course, a good many astonishing things do occur in nature, so it may be true; but on *a priori* grounds it seems to me remarkable and inexplicable.

7582. You know of nothing to support the view?—I know of nothing to support that view.

7583. (*Dr. Tunnicliffe.*) Your experiments with formic aldehyde were made, of course, technically *in vitro*?—Yes.

7584. I take it from the general results you would expect, therefore, that, supposing it were possible to administer formic aldehyde *in vivo* the quantity of undigested matter, especially the nitrogenous matter in the fæces, would be largely increased?—That would be so.

7585. That would confirm your experiments and your experiments would confirm it?—Yes; but I have not done any experiments *in vivo.*

7586. The proportions used by you in the case of the digestion of fibrin were rather strong, were they not? It comes out to 1 in 2,000 of formaldehyde. That is hardly analogous, is it, to the quantity of formaldhyde used in milk, for instance?—Yes. A drop of 40 per cent. per fluid ounce comes out to more than that. A "few drops" is what one usually hears prescribed as commonly used.

7587. That is what I should like to know—whether you have any definite evidence for the statement that you make with regard to the quantity used?—Yes, I had it worked out. I cannot do mental arithmetic here, I am afraid, but those weaker figures come out distinctly within the possible limits that are used commercially.

7588. Therefore you would say that commercial formaldehyde has been used within your knowledge in the proportion of 1 to 2,000?—Yes.

7589. Did you ever taste milk formalised in the proportion of 1 to 2,000?—I do not know that I should know that the milk had been formalised, did I ever taste it, do you say?

7590. I believe it would taste?—No.

7591. Are you aware of the fact that Foster has done some metabolic experiments with boracic acid which were published in the "Berichte des Deutsches Chemisches Gesellschaft," five years ago, and also in the "Archive d'Hygiène"? Are you aware of those experiments?—Yes. I am not prepared to stand an examination on them, but I read them, and I know something about them.

7592. Would the remarks which you made, and which I think are quite justified, with regard to Liebreich's paper, apply to Chittenden's work, which you know, I presume?—Yes, I know Chittenden, too.

7593. Would you have any hesitation in saying that Chittenden's work is from the best and highest scientific standpoint?—Yes. He is one of the first men in the physiological world.

7594. But his results are more or less the same. Chittenden shows that in certain quantities boric acid is innocuous, so far as dogs are concerned?—Yes, so far as dogs are concerned.

7595. You feel very strongly upon the subject of copper in peas, I gather?—No, I do not. It is not a question to which I have devoted very much attention, and the opinion that I expressed in answer to Professor Thorpe was more the result of the application of general principles.

7596. (*Chairman.*) Ethics?—Yes. It was more on the spur of the moment that I answered Professor Thorpe. It is not a question that I have devoted any experimental attention to.

7597. (*Dr. Tunnicliffe.*) The fact of the copper being present anyhow, and unavoidably present to a certain extent in our diet, would influence you surely with regard to your views as to copper being a foreign substance?—I do not quite follow you.

7598. The chances are that every man existing at the present moment has copper in his body—whether he takes coppered peas or not?—Yes.

7599. Although, perhaps, it is, strictly speaking, foreign to the animal body, since we cannot separate it from the animal body, do you think its foreignness is somewhat modified by that fact?—Yes. It goes on accumulating in the body, and there is no doubt that a large dose does produce effects which are bad. That, of course, is incontrovertible, is it not? One would imagine that the accumulation of this substance would similarly tend to produce effects of malnutrition.

7600. And would necessarily be more marked the older we are?—Yes.

7601. (*Professor Thorpe.*) You have given a considerable amount of attention to the chemistry of proteid bodies?—Yes.

7602. Can you tell the Committee whether our knowledge of the proteid substances present in milk is pretty accurate? Should you say that there are a number of indeterminate and indefinite things in milk of which we have no knowledge?—No; I should say that milk is about as well worked out a specimen of a proteid fluid as there is.

7603. That is to say, you think the chemistry of milk is pretty well understood?—We do not understand what a proteid is yet. With the exception of that fundamental point I should say that milk and blood are the two things that we know most about.

7604. When you say we do not understand what a proteid is do you mean by that that we do not understand the chemical analogies and relationships of the proteid, or what do you mean?—I mean we do not understand the way in which the atoms are built into the molecule.

7605. But we understand the proteid as a fairly distinct entity, capable of being isolated and characterised?—Yes. I mean to say you cannot make it in the laboratory. You do not know the way in which its atoms are pieced together; we do not know the constitutional formula.

7606. We do not know the molecular weight?—We do not.

7607. And, of course, of thousands of other substances you would say the same?—Yes.

7608. Still, it is a distinct entity?—Yes. Proteids are well characterised substances, and I should say that our knowledge of the proteids of milk are about as complete as our knowledge of the proteids of anything.

7609. Speaking from that knowledge, do you see any reason to suppose that the operation of pasteurisation, which consists in raising the milk, and, of course, the proteids along with it, to a temperature of about, we will say, 180 degrees Fahrenheit at most for a comparatively short time—five, six, or ten minutes, it may be—do you see any reason to suppose that that fundamentally alters the nature of the proteid? Is it likely?—Yes, it is likely to.

7610. You think it is likely to?—Yes.

7611. In what direction is it likely to fundamentally alter it?—It would produce a greater difficulty in digesting it. I mean to say it would become more insoluble.

7612. Is that alteration of a physical or a chemical character? Do you mean that it tends to coagulate—is that it? It does not actually coagulate.

7613. It tends to coagulate?—It tends to become more insoluble, and I imagine, too, that in the proteids of milk, where you have phosphorus either in an organic or inorganic form loosely combined with it, there would be bound to be an alteration in the relations of the proteid to the phosphorus containing constituents.

7614. Do you mean something in the nature of lecithin or something of that kind in the milk?—Something in the nature of nuclein—some substance of which the nuclei of cells are composed—and there are also inorganic phosphates which appear to be more or less loosely linked to the proteid matter, and that relationship of inorganic to organic substances is altered by boiling.

7615. How is it altered? Is the stuff, for example, in the yolk of an egg broken up by something analogous to hydrolysis, or what; what happens to this complex thing by the action of heat—what is your idea?—I imagine that it is of the nature of hydrolysis, although, of course, that again is very difficult to say without knowing the molecular constitution of the proteid material.

Prof. W. D. Halliburton,
M.D., F.R.S.
etc.

14 May 1900.

7616. What I am really driving at is this, to try and think out what change can possibly take place in pasteurised milk, which would in any way modify its effect as food, and possibly bring about some toxic action? Is there anything, speaking from your chemical knowledge, of the nature of this—anything that is *a priori* reasonable to expect would occur in milk of this nature which has been boiled?—The splitting off of a toxin from the proteids?

7617. Yes?—I should say it is extremely improbable; it must be a very mild toxin at any rate.

7618. Of course, we must have used boiled milk from time immemorial, year in and year out?—It is a slow poison if it is a poison at all.

7619. Rice puddings are a well recognised form of nursery diet for children?—Yes.

7620. And mothers have for a long period given children a diet consisting of various forms of boiled milk, and this has hitherto been considered to be the very best form of simple food that you could give to children?—Yes.

7621. Would you say, therefore, it is reasonable to expect that if there be any specific toxic action arising from the change taking place in the albuminoids of milk it ought to have been observed long ago?—It ought to have been observed and discovered long ago.

7622. Is there anything else in milk than the albuminoid portion of it which is liable to suffer these changes so as to bring about what are supposed to be the effects of sterilised or pasteurised milk?—The only thing I can think of which would indicate a rearrangement would be the inorganic phosphates.

7623. Supposing there were some slight re-arrangement of the inorganic phosphates?—That would not produce a poisoning effect; certainly not.

INDEX TO APPENDICES.

PAGE.

1. Law and practice in certain foreign countries as to preservatives and colouring matters in food - 269
2 Law and practice in the British Colonies as to preservatives and colouring matters in food - 275
3. Report on visit paid to Amsterdam, Hamburg and Denmark, in relation to the use of chemical preservatives in milk and butter - 280
4. Report on a visit to Ireland in relation to the use of certain preservatives in dairying and vegetable products - 292
5. Report upon visits to two preserved vegetable and fruit factories, together with certain experiments upon the effect of varying the amount of copper used in the preserving process upon the ultimate greenness of the preserved peas - 304
6. Report, handed in by Professor Tunnicliffe, on experiments upon the effect of boracic acid and formaldehyde upon the live weight, growth, and food assimilation of young sucking pigs - 306
7*a*. Report, handed in by Professor Tunnicliffe, upon certain experiments made upon the extent to which the copper ingested with artificially-coppered peas is absorbed and retained by the human body - 312
7*b*. Report, handed in by Professor Tunnicliffe, on the influence of formic aldehyde upon the metabolism of children - 313
7*c*. Report, handed in by Professor Tunnicliffe, on the influence of boric acid and borax upon the general metabolism of children - 337
8. Tables, compiled under the direction of Professor Thorpe, giving the results of analyses of samples of food and drink, made in the Government Laboratory, in relation to contained preservatives and colouring matters - 355
9. Railway transport of milk and butter in England - 373
10. An historical record, by Mr. S. A. Vasey, of the use of preservatives and colouring matters in food, gleaned from the volumes of " The Lancet," 1851–99 - 377
11. Statement, handed in by Mr. T. C. Smith, giving (A) Names of preservatives; and (B) Colouring matters used in various descriptions of dairy produce, and the quantities or proportions in which they are used by persons who have complied with a request for information on these subjects; (C) Names of the preservatives; and (D) Colouring matters mentioned in 110 replies to a circular letter addressed to dairy farmers and traders, with the number of persons using each - 379
12. Report, handed in by Mr. Fisher, on behalf of the Society of Public Analysts as to preservatives and colouring matters in food, drinks, and drugs - 385
13. Tables, handed in by Dr. A. Hill, as to preservatives and experiments as to preservatives in milk, butter, and other foods in the city of Birmingham, with a statement as to prosecutions in that city in respect of boracised milk and butter, 1896–99. (Tables A to M.) - 389
14. Return, handed in by Dr. W. Williams, of the legal proceedings taken against vendors of milk, butter, and ham containing preservatives, in the county of Glamorgan from March 1897 to November 1899 392
15. Paper, handed in by Dr. H. Handford, relating to (*a*) Report of Analyses of Milk from Nottingham General Hospital; (*b*) Recommendations of the medical committee of the Nottingham General Hospital with reference to the supply of milk thereto; (*c*) Analysis of milk from the same hospital; and (*d*) Report as to the sanitary condition of certain cowsheds in the Basford Rural District - 393
16. Statement, handed in by Mr. W. F. Lowe, as to his personal views on the use of preservatives and colouring matters in foods - 393
17. Letter, addressed to Professor Thorpe by the Government Analyst of British Guiana, relative to the tinting of West Indian sugar - 394
18. List, handed in by Mr. Leonard K. Boseley, of colouring matters used in confectionery - 395
19. Letter, handed in by Mr. J. Wheeler Bennett, from the High Commissioner for Canada, giving figures relating to the value of bacon and hams exported from Canada to Great Britain during 1889–98 - 395
20. Translation, handed in by Mr. J. W. Copeman, of letter from the Minister of Commerce to the President of the French Chamber of Commerce, with enclosed report of M. Riche, relative to the coppering of peas - 396
21. Certified copy, handed in by Mr. J. W. Copeman, of an order of the Prefect of La Gironde, relative to the manufacture of greened peas in that department - 398
22. Statements, handed in by Mr. J. W. Copeman: (*a*) Table of deaths from food poisoning in England, 1887–95, and (*b*) As to deaths by poison (accidental), 1888–97 - 398
23. Tabular statement, handed in by Dr. W. Williams, as to specimens of milk and butter examined in the county of Glamorgan for preservatives, with the results obtained - 399
24. Paper, handed in by Dr. S. Rideal, as to the time milk is kept sweet by the addition of boric acid and formaldehyde at various temperatures - 400
25. Extracts, handed in by Major C. E. Cassal, from his annual reports to the vestries of Kensington and St. George, Hanover Square, dealing with preservatives in food, sweetmeats, and wines, during the period 1891–98 - 400
26. Report, handed in by Mr. H. Faber, on experiments made at Copenhagen to test the keeping of fresh butter - 404
27. Paper, handed in by Mr. H. Faber, containing the opinion of the Minister of Justice at Copenhagen on the effect on health of the use of chemical preservatives in food - 405
28. Tables, handed in by Mr. W. Collingwood Williams, relating to the analyses of milk in the city of Liverpool, and in the administrative county of Lancaster for borates and formalin - 406
29. Table, handed in by Mr. W. Collingwood Williams, relative to preservatives in milk during 1899 in the city of Liverpool, the administrative county of Lancaster, and five Lancashire boroughs - 407
30. Tables, handed in by Dr. J. R. Kaye, (*a*) giving a few examples of advertised preservatives; (*b*) showing the infantile mortality in England and Wales (compiled from the Registrar General's returns), during the twenty years 1878–1897; and (*c*) Displaying the rates of infantile mortality during one eight-year period (1891–1898) in England and Wales and various parts of the country - 408

PAGE.

31. Tables, handed in by Mr. H. Droop Richmond, as to (1) Detailed analysis of commercial preservatives which have come directly under the notice of the Aylesbury Dairy Company, Limited ; (2) Percentages of boric preservative in butters ; and (3) Length of time in hours that milk will keep at various temperatures when preservatives are added - - - - - - - - - - - - - 409
32. Paper, handed in by Mr. H. Droop Richmond, relating to the experiments on the use of hydrofluoric acid and chloroform as preservatives, and of fluoboric acid in cream - - - - - - - - 410
33. Paper, handed in by Mr. J. M. Harris, containing a report on the testing, as to the penetrative power of boric acid, of three pieces of bacon - - - - - - - - - - - - - - - - - 410
34. Statement, handed in by Dr. P. Schidrowitz, on the use of preservatives in beer - - - - - - 410
35. Tables, handed in by Dr. P. Schidrowitz, containing results of experiments on milks, both cooled and uncooled, as to their keeping power both with and without admixture of formaldehyde and boric acid of varying strengths - - - - - - - - - - - - - - - - - 412
36. Memorandum, by Mr. Boyd Kinnear, on the use of preservatives in dairy produce - - - - 413

APPENDIX.

APPENDIX NO. I.

LAW AND PRACTICE IN CERTAIN FOREIGN COUNTRIES AS TO PRESERVATIVES AND COLOURING MATTERS IN FOOD.

Appendix.

Summary of data obtained by the Foreign Office.

AUSTRIA-HUNGARY.

No special law obtains. Ministerial decrees are, however, in force prohibiting the use of certain well-known preservatives and colouring matters in foods. Prominent analytical chemists are engaged in preparing a "code" which will, doubtless, form the basis of a law, regulating *inter alia* the use of preservatives and colouring matters. Generally, at present, exceptions to prohibition of preservatives are made only in respect of salt in butter to 5 per cent., and both salt and saltpetre to unlimited extent in meat preservation. Opinion divided as to salicylic acid, as it is used medicinally up to one-gramme doses, and small quantities are tolerated in foods not likely to be given to children or invalids. But in milk, salicylic acid, borax, boracic acid, and soda are forbidden. The use of saccharine is especially forbidden, but (?) for commercial reasons only.

In Austria-Hungary a decree of 1866 forbids in food the use of any colouring matter which contains metals (iron excepted), gamboge, picric acid, or aniline. But in 1895 a large number of aniline dye stuffs which do not contain arsenic were permitted to be used for sweetmeats, liquors, etc., specimens of such colours to be yearly submitted to official examination. Ultramarine only permitted when free from arsenic, and in such small quantity that in a 10 per cent. solution of water its presence is not distinguishable. All harmless vegetable colourings are allowed, and saffron, safflower, chlorophill, and cochineal are largely employed.

Probable that shortly a decree will permit minute quantities of copper in preserved fruits and vegetables, as infinitesimal amounts, too small to injure health, suffice to preserve colour.

BELGIUM.

The Government can by the law of 1890 prohibit the employment of matters dangerous or injurious to health in foods, and a decree of 1896 prohibits the sale of lard or other fats added to antiseptics or glycerine. A decree of 1894 prohibits absolutely the use of preservatives in milk.

DENMARK.

Summary of Laws and Regulations in Force.

The law of 1897 prohibits the use of all preservatives, other than cooking salt, in butter or margarine, even for exportation. The Minister of Agriculture may, "under necessary control," allow butter or margarine not in accord with the law, which has been imported, to be either exported or immediately sold for inland consumption.

Articles of food must not be subjected to treatment intended to conceal their deteriorated condition.

The Ministry failed to carry a clause in 1897 which aimed at the prohibition of substances in foods which, while inoffensive in themselves alone, might have dangerous consequences if their absorption was continued. The sentence referred to runs as follows: "Moreover the Minister of Justice shall be authorised to forbid, by means of regulations to that effect, the addition to food destined for sale, of substances, inoffensive in themselves alone, but whose continued absorption may have dangerous consequences."

As regards this clause the following remarks are made by the Danish Ministry:—

"The manager of the laboratory for chemical analysis employed by the State for the examination of victuals has informed the Ministry of Justice that in this country admixtures to victuals (milk amongst others) are used to rather a high extent with the purpose of preserving these better, that the admixtures most frequently used for preservation are boracic acid or preparations of same and salicylic acid, and that the continual consumption of victuals for the preservation of which boracic acid in larger quantities or salicylic acid has been used, must be supposed to cause danger to the health of the consumers. The Ministry having therefore put the matter before the Royal Sanitary Committee for consideration, they have declared that boracic acid and preparations of boracic acid might have a fatal influence on the state of health, if the quantity of 1 gramme or even less of these substances has during some time been brought into the organism by the consumption of victuals prepared with these substances. Further that boracic acid used as admixture to victuals (milk) for small children might be dangerous even if the quantity is comparatively small, and that the use of salicyclic acid and its preperations used for the same purpose should never be allowed on account of the dangerous influence of these substances.

"Several sanitary committees are authorised by local sanitary regulations, for instance by section 31 of the sanitary regulations for Copenhagen, confirmed June 15th, 1886, to take steps against abuses of the above-mentioned kind (eventually by the issue of a general prohibition for the territory of the community concerned). The Ministry is, however, of the opinion that it would be advisable to have similar rules for all communities, and that this could easiest be arranged if the Ministry were empowered to issue a general ordinance to this effect. Considering the circumstances it is undoubtedly an anomaly that the Ministry can issue by ordinance rules as to whether and to what extent substances injurious to the health may be admixed to wine and spirits, while the Ministry has no corresponding power as regards other victuals. This anomaly is the more apparent as the Ministry of Justice in Section 1 of Ordinance of April 17th, 1894 (issued in accordance with Section 5 of the law of April 1st, 1894), has ordained that the above-mentioned substances boracic acid and salicylic acid amongst others should not be allowed to be admixed to produces which are sold as wine or (in accordance with Section 12 of the ordinance), cognac, rhum, or arrac.

Appendix.

"Provided that the present Bill is passed the Ministry intends to issue an ordinance similar to the one of April 17th, 1894, to be in force from October 1st, 1897, for the following three years.

"Finally it has been thought proper to mention expressly in an inserted clause to Section 6 that whoever infringes the regulations issued in accordance with Section 5 will be subjected to a penalty."

As regards wines and spirits it is prohibited to sell:—

(a) wines admixed with glycerine,
(b) a produce as wine,
(c) produce under the name of cognac, rhum, or arrac,

when admixed with any of the following, or other substances which may be injurious to health, namely:—

Alum, or other soluble aluminium salts,
Barium compositions,
Strontium compositions,
Magnesium compositions,
Boracic acid,
Salicyclic acid,
Raw spirit (containing free amyl alcohol),
Raw starch sugar (not chemically pure),
Kermes,
Aniline.

It is further prohibited to sell, without a declaration which shall state expressly the nature of the goods, wine to which has been admixed:—

(1) Saccharine,

(2) Bouquet substances as ethereal oils, composed ethers, essences, or similar ingredients, or

(3) Gum or other organic or inorganic substances which might increase the quantity of body of the wine.

It is permitted without declaration:—

(1) to use the common modern clarifying substances such as albumen, gelatine isinglass, Spanish earth, etc., or such other similar substances as are not deemed to be injurious to health;

(2) to correct acidity in wine with pure precipitated carbonic lime;

(3) to sulphur the casks in the usual manner by burning chemically pure sulphur;

(4) to pasteurise wine;

(5) to blend different wines; fully fermented wines must only be blended with wines of the same species.

Fully fermented wines.

(usually called "light wines").

The sale of fully fermented wines (red or white) containing more sulphuric acid than 2 grammes neutral sulphuric potash to 1 litre is prohibited.

Declaration is required if other colouring matters than those made of wine are admixed to fully fermented wines (red or white).

The addition of sugar of any kind in substance or in solution to fully fermented wines (red or white) is prohibited unless declared at the time of sale.

FRANCE.

The Use of Colouring Matters and other Materials containing Poisonous Substances.

A decree dated December 29, 1890, sets out the provisions of the French law as to this matter.

This decree consists of

1. A list of colours the use of which is prohibited in the colouration of any foodstuffs whatever.

2. A list of certain coal tar derivatives which are exempted from the operation of the general provision above referred to, and which may be used in the colouring of sweetmeats, lozenges, ices, and liqueurs.*

3. A list of colours which are specially prohibited in the colouring of paper or cardboard used for wrapping up any foodstuffs whatsoever.

4. The proportions of tin, lead, and arsenic which shall be allowed to enter into the composition of tin-leaves or tin-paper used for wrapping up any foodstuffs whatsoever.

5. The proportions of tin, lead, and arsenic which shall be allowed to enter into the composition of the alloy used for the tinning and retinning of vases and utensils serving for the use of foodstuffs.

6. The proportions of tin, lead, and arsenic which shall enter into the composition of tin vases and utensils destined to contain, or to prepare, any foodstuffs whatsoever.

The Use of Preservatives and Colouring Matters in Wine.

By the provisions of the law of January 11th, 1891, Art. 2, the use in wine of products such as sulphuric, nitric, hydrochloric, salicylic, or boric acids is prohibited, while chloride of sodium is only permissible to the extent of 1 gramme per litre. Similarly the use of any colouring matter whatsoever in wine, "vin de sucre,"* "vin de mare,"* or raisin wine, is an offence against the law.

The Use of Colouring Matter in Margarine.

By the law of April, 1897, colouring matters may under no circumstances be added to margarine.

Salicylic Acid.

As a result of representations made to the French Government as to the danger to be anticipated from the use of salicylic acid in the preservation of foods, the question was submitted to the Consulting Committee of Public Hygiene. This body, after analysing many products containing salicylic acid, came to the conclusion that the drug in question was dangerous, not only by reason of the direct effects which it produces upon the organism, but also by its indirect influences in permitting the fraudulent introduction into food stuffs, more particularly into raisin wine and into beer, of other harmful or at least unwholesome substances. The Committee considered that all solid foods and all drinks containing any quantity whatever of salicylic acid or of any of its derivatives were to be regarded as suspicious, and that it was necessary to prohibit the sale of such substances. By an Order dated February 7th, 1881, the employment of salicylic acid as a preservative was prohibited.

Formalin.

As regards the use of formalin as a preservative, the Minister of the Interior, in a circular to the Prefects dated October 18th, 1899, states, apparently upon the authority of the Consultative Committee of Public Hygiene, that although the amounts necessary to bring about preservation cannot, strictly speaking, be regarded as toxic, they arrest, or at least retard, the "useful fermentations." This preparation cannot, therefore, be daily used internally, and in a continuous fashion, without serious danger. It is also thought that antiseptics thus used frequently serve not to bring about the preservation of wholesome food, but to hide the alteration of foods of bad quality. In view of these conclusions the Minister of the Interior prohibited the sale of foods containing formalin.

GERMANY.

By the law of 1879, spoilt goods sold in a state concealing their real condition render the vendor liable to penalty. The same, with penal servitude in addition, holds good of articles sold which are injurious to health.

A Bill is now before the Reichstag dealing with meat inspection, and having concern with the partial regulation of the preservation of meat stuffs.

The German law of 1887 says: "Colours detrimental to health are not allowed to be used in the preparation of food, and of other articles for domestic use intended for sale. Colours injurious to health, within the meaning of this section, are those coloured substances and coloured preparations which contain antimony, arsenic, barytes, lead, cadmium, chromium, copper, mercury, uranium, zinc, tin, gamboge, corralline, picric acid."

The use of vessels, wrappers, or coverings containing colourings of the kind referred to is prohibited in the storing or packing of foods. But "prohibition does not apply to sulphate of barium (sulphate of baryte, blanc fixé), coloured lacs of baryte which do not contain carbonic barium, chromic oxide, copper, tin, zinc, and their alloys, as metallic colours, cinnabar, peroxide of tin, sulphide of tin as mosaic gold, nor of colours baked in glassmetals, glazes, or enamels, nor to the external coating of vessels made of watertight materials."

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* The sanction herein extended to the use of certain colours derived from aniline was apparently the result of the progress made in industrial chemistry in the preparation of the colours in question, such progress being regarded as permitting the use of the specified colours without danger to the public health.

By a recent decree, dated February 16th, 1901, the use of "jaune de napthol" is sanctioned as a colouring agent for "pâtes alimentaires."

* The composition of these wines is defined by the law of July 11th, 1890.

The law of April 20th, 1892, respecting the treatment of wines and of vinous liquors, viz.:—

"Section 1.—None of the following substances, nor mixtures containing any of them, are to be used in the preparation of wines or vinous liquors destined for human consumption, nor to be added to such liquors subsequently: Soluble aluminous salts (alum, etc.), compounds of barium, boric acid, glycerine, kermes barries, compounds of magnesium, salicylic acid, impure spirits (*i.e.*, containing pure amyl alcohol), impure starch sugar (non-technically pure), compounds of strontium, and colouring tar stuffs."

"Section 3.—The following are not considered as acts of adulteration or counterfeiting of wine in the sense of Section 10 of the Law of May 12th, 1879:—

"1. The recognised mode of treatment of wines in the cellar, including the methods for preserving them, even though one of the following substances should be added to the wine—alcohol or small quantities of fining substances with mechanically operative qualities (white of egg, gelatine, isinglass, etc.), or small quantities of cooking salt, tannin, carbonic acid, sulphurous acid, or sulphate. In the case, however, of wines which are brought into the market as German wines, the amount of added alcohol should not exceed the proportion of 1 to 100."

The subject of colouring matters in sausages and chopped meats has also engaged the attention of the Imperial Board of Health.

ITALY.

Colouring of margarine is prohibited for fraud purposes. By the law of 1894, prohibited noxious colours in preparation of foods are to be scheduled, and this also as regards wrappers for foods.

NETHERLANDS.

In the Netherlands, by the law of 1889, butter must not contain any foreign ingredients except salt and colouring matter.

The following is a translation of a Note from the Government on the general question of the use of preservatives and colouring matters:—

The inspector of the State Medical Service in Zeeland and Westerly North Brabant mentions the following as preservatives used in his district:—

1. Salicylic acid in beer and currant juice.
2. Saltpetre alone or mixed with borax in meat.
3. Borax and boric acid in milk and butter.

And as colouring matters:—

1. Aniline in artificial lemonades, sugar work, and confectionery.
2. Carmine in sausages.

As regards the injurious character of the aforesaid preservatives there is little to be said, as it depends in a great measure on the quantities that are used.

The colouring matters above mentioned may be classed among the harmless materials provided that the aniline, as seems to have been the case of late years, is free from arsenic.

According to the Inspector for Gelderland and Utrecht, caramel (in vinegar), salicylic acid, borax are used as colouring and preservatives, and are harmless, and Schweinfurt green, chromat yellow, lead mixtures, etc., are used, and must be accounted dangerous.

The Inspector for North Holland has made the accompanying return of colouring and preservatives, found by the Communal Sanitary Service of Amsterdam, in various food stuffs. A note is made that among them are:—

1. Some that may have an injurious effect on the health.
2. Some that, although if they are taken only once, are not to be considered as directly injurious, still if persistently taken may be considered as injurious to health.
3. Some that, although themselves harmless, when mixed with injurious substances, *e.g.*, aniline colouring matters with arsenic, may have an injurious effect, either directly, or after having been taken for a long time.
4. Some that, although perfectly harmless in themselves, *e.g.*, annatto, are used to make up food stuffs of bad quality, *e.g.*, diluted milk to appear of good quality.

The Inspector for Friesland and Groningen makes mention of the occurrence of salicylic acid in beer. In most cases the quantity of salicylic acid added for preservation weighed less than 10 grammes per hectolitre. Salicylic acid is also used for preserving the juices of fruit. The use of colouring materials has been now and then detected.

He goes on to say that so far as he knows no injurious results have ensued from the use of food stuffs or drinks mixed with salicylic acid in the usual quantity, but that in no case the addition must be considered as free from injurious effects, as that depends upon the quantity and the frequent consumption.

The Inspector for Overyssel and Drenthe makes mention of a report received from the examiner of food stuffs at Zwolle, from a chemist, relating to three preservatives for meat, which he had submitted for examination. The first, an English article, with the name of "Meat Preserve Crystal," consisted of sulphuric acid soda, the second named "preserving salt," a mixture of boric acid, saltpetre acid, and kitchen salt, the third named a "Harmless preservative" of sulphuric acid, lime, and water, containing sulphuric acid.

These articles seem to be much in use. We need not fear that they will do much harm, and only the last one would perhaps produce symptoms of poisoning. But the chief danger lies in the circumstance that the recognisable marks of decomposition are disguised by the sulphuric acid, so that the control on tainted meat is impossible. There is no law in this country relating to the examination of foodstuffs as to the presence of injurious preservatives or colouring matters. This subject is regulated by the instructions of the communal authorities.

Adulteration of foodstuffs is made punishable in Art. 330 of the Criminal Code, which runs as follows:—"All persons selling, offering for sale, or delivering foodstuffs or drinks or drugs, knowing them to be adulterated, and not mentioning that adulteration shall be punished with imprisonment not exceeding three years.

"Foodstuffs or drinks or drugs are considered as adulterated whenever their value or their usefulness is diminished by their mixture with foreign substances."

Return of Colouring Matters and Preservatives found in various Food Stuffs and Articles of Consumption by the Communal Sanitary Service.

Food-stuff or Article of Consumption.	Colouring Matter.	Preservative.
Milk	Orlean or annatto	Formaldehyde, borax, boric acid, preserving salt (= boric acid + natrium nitrate+kitchen salt).
Butter	Aniline (=	—
Cheese	Victoria yellow	Linoscorium or cheese preservatives.
	Orlean	= water glass + a little ferrocyan mixture + sporon of chloride and sulphuric acid mixture.
Wine	Fuchsine	Salicylic acid.
Cognac	Caramel.	—
Beer	- - - -	Salicylic acid.
Currant juice	- - - -	Salicylic acid and sulphuric acid.
Liqueurs	Aniline colouring matters.	—
Lemonade	- - -	Salicylic acid. Benzoic acid.
Sugar-work	Aniline colouring matters, ultramarine, death's head, oxide of zinc.*	—
Saffron	Aniline colouring matter, red chalk.	—
Fruit-jelly	- - - -	Salicylic acid.
Gherkins	Sulphate of copper	—
Sausages	Fuchsine, cochineal	Bisulphate of calcicus.
Meat	- - - -	Bisulphate of calcicu an sulphate of calcicus.

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* A green colouring matter = Berlin blue + oxide of zinc + sulphate of antimony.

NORWAY.

STATEMENT as to the use of preservative and colouring matters for the preservation and colouring of foodstuffs in Norway and their effect upon health, compiled by Mr. T. F. Somerville, of Christiania.

Authorities consulted:—

Reports by Mr. L. Schmelck, Public Analyst to the City of Christiania.

Reports from the Christiania Board of Health.

The Criminal Code of Norway.

"Forfalskning af Levnetsniedler," by Mr. E. Simonsen, Analytical Chemist and Government Stipendiary.

Discussion before the Criminal Law Commissioners respecting the question of imposing penalties for the falsification of articles of diet.

Newspaper reports: Various.

The use of Preservative and Colouring matters for the preservation and colouring of foodstuffs in Norway, and their effect upon health.

The question of the admissibility of preservative and colouring matters in connection with articles of diet, and the effect upon health of several such substances, has been the subject of much discussion in Norway of late years, as the law existing hitherto is unable to cope with the difficulties that arise—in fact, the only paragraph in the Criminal Law directly dealing with the adulteration of food in general, seems only to provide punishment for persons who either wilfully put poisonous substances into food, or who, after accidentally or in ignorance having mixed such things as could endanger the life or health of their fellow creatures with food, neglect doing all in their power to avert the possible consequences when made aware of the danger. No punishment under the criminal law is attached to adulterations of uninjurious nature. There are, of course, some special laws, such as those regulating the excise, prohibiting certain substitutes or surrogates, as saccharine for malt in brewing, or of margarine for butter; but the law has been found so deficient and unsatisfactory on the whole, that a new special law has been drafted and will be introduced shortly in the Legislative Assembly (Storthing).

In the course of the discussions which have taken place preparatory to drafting the new law, the most valuable evidence is probably that of Mr. L. Schmelck, the Public Analyst to the City of Christiania.

Mr. Schmelck mentions as the principal preservative at present used for meat, sulphite of soda. This powerful preservative first came into use in Christiania about 14 years ago, and as then applied to the outside of carcases or even to joints of meat, was not considered injurious to health. Sulphite of soda not only keeps meat perfectly fresh for a considerable time, but it improves the appearance and enhances the bright colour of the meat. Moreover, it is able to restore, to a very great extent, the appearance, smell, and taste even of meat that has already become bad.

Owing probably to the toughness of most kinds of meat in Norway, a very large proportion of the butchers' meat consumed in Christiania, and in the towns generally, is sold in a minced condition, either plainly minced, to be made up into "Vienna beefsteaks," "meat cakes," or "minced collops," or as sausage-meat or forced-meat.

The minced-meat sold in Christiania has been more and more treated with sulphite of soda, until it has become the rule, instead of the exception, to find it mixed with from 0·2—two-tenths of one—per cent., to 1·0—one—per cent., while the brightening and preservative effects upon fresh meat are observable when only 0·05—half of one per thousand—is used.

There could be no doubt that the actual consumption of such comparatively large quantities of sulphite of soda might be dangerous to health, and there would be great difficulty in effectively controlling a limited percentage of this preservative if sanctioned—and danger might arise through meat, that was unfit for food, being restored to an apparently eatable condition. The Christiania Board of Health, therefore, recently stepped in and prohibited the sale or exposure for sale of viands containing any sulphite of soda. The butchers and meat-salesmen, sausage-makers, and others continued, nevertheless, to use the preservative, and a test case has just resulted in a conviction.

The new law, above alluded to, will doubtless provide stringent measures to prevent adulteration.

Boracic acid is occasionally found, in both butter and margarine, and a preserving medium obtained from England, which has been used by some manufacturers of margarine, has been found to consist of about 60 per cent. boracic acid, 30 per cent. saltpetre, and 10 per cent. chloride of soda (common salt). The Board of Health has taken measures to prohibit the use of boracic acid for the preservation of food-stuffs.

The colouring matters generally used have not been considered injurious (annatto and the German "buttergelb"), but aniline has occasionally been detected.

Benzoic acid has been found to the extent of 0·1, one-tenth of one per cent., in sacramental wine that was free from alcohol, and this has been prohibited.

Aniline colours are frequently used in fruit-syrups and effervescing beverages, but the Board of Health has not found it necessary to do more than caution certain manufacturers and to let the public know, through the Press, what to avoid, and the use of such matters is diminishing.

Crocein, eosin, and other artificial colourings are used by sausage manufacturers, and are found in many imported sausages.

Of injurious additions detected in imported foodstuffs, the principal are boracic acid in English and American horse-flesh, and oxide of zinc in American dried apples, copper in French "Petits pois" (tinned green peas), but only occasionally in such quantities as to be dangerous to health. The amount of oxide of zinc in American dried apples has, however, been at times so great as to lead to their confiscation (0·004 to 0·256 per cent.)—the zinc is not purposely added, but its presence is due to the apples being dried on zinc, or so-called "galvanised" sheets.

Wines.—Owing to various Treaties of Commerce, the Customs duty on wines is very small, being only 11·5 Ore (eleven ôre and a half, or less than three halfpence) per litre on wines containing up to 23 per cent. in volume of absolute alcohol; and as the Customs duty on imported spirits is very heavy, and even the excise duty on the native brandy exceedingly high, the cheapest intoxicant obtainable is wine fortified up to the limit. Moreover, wine is sold by all sorts of tradesmen; for instance, by nearly all tobacconists, pastry-cooks, bakers, etc., as well as by all grocers, and at all kinds of restaurants and inns, while spirits are only sold in some of the large towns. The natural consequence is, that adulterated "wines" of the "Hamburg" type, which retail at sixpence a bottle, have been imported of late years in enormous quantities, and the Government has taken special measures to endeavour to rectify the evil, and rigorously requires proof to be furnished that the wine has been sent direct from the country of origin without any subsequent doctoring.

Spirits.—The "Aquavit" or ordinary native brandy is now-a-days more often distilled from potatoes than from corn. It is usually a pure, silent spirit, flavoured with carraways, and the strength is from 32 to 45 per cent. of pure alcohol by volume, which may probably correspond with the usual "bottling strength" of most whiskies, viz., from 15 or 20 degrees below proof, up to about proof. Some samples have contained somewhat large quantities of amyl alcohol, and traces of formaldehyde, etc., but there does not appear to be any complaint of adulteration in the ordinary "aquavit." The same spirit is, however, also made up into imitation cognac, and other liquors, which must contain considerable quantities of flavouring and colouring matters.

So soon as the new law is passed and comes into force, it will be possible to deal with a number of adulterations, which at present cannot be attacked by the Board of Health, or by any special Act, but which render the goods purchased other than what they ought to be—either by concealing defects or enhancing appearance, or by being partially or wholly substitutions or adulterations of inferior or worthless, though innoxious matter.

SWEDEN.

TRANSLATION of a document containing details of the legislation on the subjects of preservatives and colouring matters in food.

In the documents annexed to the dispatch* there are three questions to which answers are especially desired.

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* Not here reproduced.

These are :—

(1.) Whether the use of such means, or any of them, for preserving or colouring articles of food in certain quantities is dangerous to health, and in that case, in what proportions the using of them becomes injurious.

(2.) To what extent and in what quantity are they used at present?

(3.) What may be considered to be the quantity of the additions, their nature, and relative existence?

Regarding questions 2 and 3, the following may be said :—

Already six or seven years ago a preservative for meats was introduced into the trade in Stockholm, named "Best Australian Meat Preserve."

On being chemically examined here, this preparation was found to consist of a solution of sulphurous acid lime. It was stated to be composed of 22·5 grammes lime and 77 grammes sulphurous acid to one litre of water.

This preservative, which was pretty generally used by meat dealers, butchers, and sausage makers here, especialy during the warm season, has, however, now, and particularly during the last two years, been more and more driven out by preservatives in dry form, viz., partly a preparation called preservalin, partly another preservative salt, which, to some extent, is imported from Germany, and is also manufactured at a couple of places in this country.

In pursuance of the dispatch from the Royal Medical Board of Health ("Konglig Medicinalstyrelsen") I have taken samples of colouring and preservative matters at all the sausage-making establishments in the capital, and they have in the majority of cases been found to consist of either of the preparations mentioned below :—

The "Preservalin"—preserving salts that are used here are, according to statement, manufactured by the Preservalin Manufacturing Company, New York, and other places in America.

They are named A, B, and C Preservalin.

Preservalin "A" is a white powder, which, according to the chemical analysis made at my request by Mr. K. Sondén, Engineer and Chemist to the Board of Health of Stockholm, consists of common kitchen salt and borax.

Preservalin "A" is intended to be used for the preserving of fresh meat, pork, meat—and liver—sausages, etc., and it is stated in the directions for use that the quantity which is required in order to obtain a good result ought to be one kilogramme to 500 kilogrammes of meat.

Preservalin "B," which is used both for preserving and colouring all kinds of smoked sausages, is composed of a pale red (pink) salt, which, according to an analysis made by the said Mr. Sondén, was found to consist of common kitchen salt and saltpetre, together with some organic colouring matter, and should, according to the directions for use, be employed in a dose of 100 grammes to 20 kilogrammes of meat.

As regards the rest of the preservative salts which are used here, the domestic ones are generally called only preserve-salt ("Konservsalt"). Some of these articles are imported from Germany, from the firms of O. Leidler, Wernigeróde a/H., Leonard and Marins, of Berlin, and others, under the name of "Meat Preserve Crystal."

These last-named salts have, according to an analysis made by Mr. Sondén, been found to be composed of sodium, sulphite, and sulphate.

Very recently and last of all, two new preservative substances have found their way into the trade, "Zanzibar Carbon" and "Freeze-em." These preparations, the former of which also serves as colouring matter, are manufactured by Messrs. B. Heller and Co., Chemists, Chicago, United States, America, and consist, according to an analysis made at the Reichsgesundheitsamt, Berlin, the former of 75 per cent. of common kitchen salt and 25 per cent. Bismarck brown, the latter of water free sodium-sulphite with 15·6 per cent. of sodium-sulphite and traces of chloride of sodium and sodium carbonate.

"Zanzibar-Carbon" is chiefly used for so-called after colouring of smoked sausages, which process is done by the sausages being boiled in water to which "Zanzibar-Carbon," in a dose of one teaspoonful to 300 litres of water, has been added.

I have received information from Mr. C. L. Blomgren, Town Veterinary, Gothenburg, regarding the use of colour and preservatives for the colouring and preserving of meat and food prepared therefrom, to the effect that "meat-preserve" and "meat preserve-crystal" are chiefly used there, which preparations likewise contain sulphurous acid natron.

In Gothenburg, candies and mannacroup have been found in the trade coloured with chromate of lead, and in jams and fruit-juices salicylic acid has been found.

In a sample of varnish used for smearing hams in order to give them a nice colour and a shiny surface, arsenic has been found by the Town Chemist, Gothenburg.

Hydrate, according to the opinion of the Town Veterinary, Gothenburg, is sometimes used for the preserving of herring and anchovies.

The Town Veterinary furthermore refers to the report of the Gothenburg Board of Health for the years 1897 and 1898 :—

In the former it is stated, among other things on this subject, on page 39, as follows :—

Some hydrate preparations accessible to the public have been examined for the Board of Health.

(1) Preservitas from the Preservitas Co., London.

(2) Ordinary antiseptic fluid ("Enkel Aseptin").

(3) Double antiseptic fluid ("Dubbel Aseptin").

Both these last are from Henrik Gahn's Aseptin, Amykos Co., Limited, Upsala, Sweden.

The analyses of these preparations have given the following results :—

——	Preservitas.	Ordinary Antiseptin "Enkel Aseptin."	Double Antiseptin "Dubbel Aseptin.'
	Per Cent.	Per Cent.	Per Cent.
Hydrate - - - - -	78·92	99·95	77·19
Common kitchen salt - -	9·20	—	22·81
Saltpetre (Kaliumnitrat) -	9·53	—	—
Other (humid matters) -	2·34	0·05	—

Regarding the sale prices of these preparations it may be mentioned that :—

1 kilogramme of Preservitas costs 2·62 öre (2s. 11½d.),

1 kilogramme of Ordinary Antiseptin costs 2·94 öre (3s. 3d.),

1 kilogramme of Double Antiseptin costs 3·00 öre (3s. 4d.),

while the chemist's shop "Enhörningens" Drug Stores, here, according to its price-list, charges 70 öre (9½d.), for acidum boricum venale, "borsyra."

In the spring a quantity of herring was found in a fish dealer's store preserved in hydrate. Of this herring, as well as of the brine in which it was packed, a health officer took a sample which was examined as to its hydrate percentage, with the following result :—

	Herring.	Herring brine.
Hydrate ("Borsyra")	0·83 per cent.	1·59 per cent.

In the Report for the year 1898, it says on page 42 :—

A meat preservative named "Meat Preserve" from the factory Saturnus, at Malmö, Sweden, F. G. Borg, Apothecary, owner, has been examined on behalf of the Board of Health. It showed a pale, yellowish, somewhat turbid fluid, with a strong odour of sulphurous acid, being of an actual weight, at 15 degrees Centigrade, of 1·074.

There was in a litre of this fluid :—

Solid matters (after evaporation and drying) - - - - - - -	50·4 grammes
Sulphurous acid - - - - -	83·4 ,,

The sample chiefly consisted of a water-solution of acid sulphurous lime.

After this résumé of the different preservatives and colouring matters which at present are used in the two largest towns in Sweden, question (1) remains to be answered, viz.:—"Whether the use of such matters for preserving or colouring foods in certain quantities is dangerous to health, and in that case, in what proportions the using of them is injurious."

The injurious effects of the preservatives in question, irrespective of their different characters, depends of course to a great extent on how they are used.

The manner of using them is very different in different places.

While some tradesmen apply the preparations in accordance with prescriptions, others handle them entirely at random, indeed, so carelessly that they can hardly tell the approximate quantity that is used by them for the colouring and preserving of the various foods.

With respect to the question of the injurious effects of the preservatives, it may be said that sulphurous acid certainly is a good preservative for the muscle colouring matter ("muskelfärgämnet"), but not for the meat itself. By employing sulphurous acid-salts the meat can be made to retain its natural colour, even after it has become tainted, and in this there is no small danger, inasmuch as the buyer by this means easily can be misled regarding the actual quality of the meat, and especially of mince meat—since old mince meat and sausages can be sold as fresh, for the changes of colour which otherwise take place in the muscle colouring matter ("muskelfärgämnet"), after the adding of the salts, do not appear at the same time as the tainting sets in.

An addition of sulphurous acid-salts makes it furthermore possible to add water to mince meat without it losing the colour of fresh meat.

Shorer has furthermore pointed out that the mixing of sulphurous acid and its salts may be disadvantageous even to the seller, because the sulphurous acid often is turned into hydrogen sulphide, which, owing to its disagreeable smell, makes the meat entirely unsaleable.

This observation is fully in accordance with the opinions of the better class (that is to say), the most honest, sausage makers in Stockholm, who consider that the use of such artificial preservatives and colouring matters can damage the reputation of the profession, and therefore they have declared that they would have no objection to their prohibition. These men say they have been compelled to adopt them in order to enable them to compete with the tradesmen who began using them.

As regards the suitability of sulphurous salts added to mince meat, etc., and its sanitary significance, the Imperial Board of Health at Berlin (Das Kaiserliches Gesundheitsamt) has expressed itself as follows:—

1. From fresh butcher meat without chemical preservatives, but with due observance of cleanliness, mince meat can be produced, which, if kept at a low temperature, will retain its natural colour for more than 12 hours.

2. The addition of preservatives which contain sulphurous acids and similar salts can improve the natural colour of the meat, but not the meat itself. By their means mince meat can appear to be of better quality than it really is.

3. The frequent consumption of mince meat which is treated with sulphurous acid salts may be injurious, particularly to people of delicate health.

The whole profession will certainly agree with this expression of opinion, given by such expert authorities as the Imperial Board of Health of Berlin, and to my knowledge this opinion is the prevailing one among the controllers of meat in Germany.

SWITZERLAND.

No Federal law, but several cantonal enactments prohibitive of preservatives.

In the Canton of Zurich a law of 1896 prohibits the employment of all preservatives save cooking salt and saltpetre, but borax continues to be largely used.

The following is a translation of extracts from a letter from the Government, dated September 5th, 1899:—

. . . . We forward a reply to your request, only regretting that the circumstances, which we shall explain to you, do not permit us to give you information as precise as we should have desired.

In the absence of a federal law upon the regulation of foods there are the cantonal laws and ordinances which regulate for the moment the employment of antiseptics and colouring matters in the preparation of these commodities. . . .

It will be difficult, if not impossible, to inform you upon the importance which the employment of antiseptics and colouring matters in the manufacture of foods has received in our country; there exists, in fact, neither publications nor documents which give us upon this subject precise information. We only possess the reports of the cantonal chemists—that is to say, the chemists who in certain cantons are charged with the control of foods. But it is easy to understand that with the multiplicity and the diversity of our cantonal legislations, these reports, which besides are only published by a small number of cantons, can only form a base for estimation upon the question which occupies us. Therefore we will confine ourselves to extracting the most important from among them. These may perhaps afford some information which will be useful.

Laboratory of Canton of Bâle-Viele, 1897.—18 per cent. of the sausages examined (20 out of 111) were artificially coloured, for the most part by an aniline dye, orange R. Two samples of raspberry lemonade were in reality coloured by means of an aniline dye. A product imported from England under the name of Queen's Lemon Squash consisted of a dilution of citron juice added to about 5 per cent. of salicylic acid.

The same laboratory, 1898.—Two samples of margarine contained boric acid.

A salt preserve manufactured at Wittenberg and sold under the name of "Meat Preserve Krystall," was a compound of sulphite of soda and Glauber's salt. A bit of meat treated by means of this salt contained 172 milligrammes of sulphurous acid per 100 grammes. Fifteen samples of sausages were artificially coloured. A lemonade was coloured by means of an aniline colour, the odour of which resembled that of naphthylamine. This colour was seized and destroyed upon the premises. All manufacturers of lemonade with the exception of one, who only uses a syrup of raspberries, use for making their products aniline essences and colours without giving a special designation to their lemonade.

Laboratory of the Canton of Zurich.—Although an order of 19th December, 1896, prohibits the employment for the preservation of meats of other substances than cooking salt and saltpetre, in 1897 out of 55 specimens of meat examined at the laboratory 27 still contained boric acid or borax, the same substances have been found in six samples of sausages, five other samples of sausages were coloured by means of an aniline dye. Out of 2,032 samples of wine examined one alone was artificially coloured.

Laboratory of the Canton of St. Gall.—At St. Gall foods coloured artificially or preserved by the aid of antiseptics appeared especially to come from abroad. Thus samples of American meat examined in 1897 and 1898 contained boric acid. Dried apples of American production contained traces of zinc (1897 and 1898). In 1898 the laboratory has had to analyse Austrian butters coloured artificially or treated with salicyclic acid.

Laboratory of the Canton of Thurgovie.—The greater part of the American meats analysed in 1897 contained boric acid.

Laboratory of Canton of Berne.—Colouration of pastry by "jaune de Martius" tends to disappear; in 1897 only two samples were found coloured by this process; in practice inoffensive colours are employed. A preserve of yolk of egg examined in 1896, and coming from Germany, contained salicylic acid. The laboratory has often enough had to analyse wines sulphured or clarified too much with gypsum. Some samples contained as much as 186 milligrammes of free sulphurous acid per litre; others as much as 47 grammes of sulphate of potash per litre (limit allowed two grammes). However, wines too much clarified with gypsum are becoming rare. Such are some extracts which we have been able to take from the reports of the cantonal chemists during recent years. They do not permit of a complete account being stated of the amount in which the processes of manufacture, which the English Committee proposes to study, are used in Switzerland. One is able only to conclude from it that these processes are utilised by our manufacturers. We greatly regret not being able to furnish you with indications more complete and more precise.

We are, etc.,

(Signed) Hauser, Vice-President.

UNITED STATES.

No maximum limit laid down as to preservatives. But those having no marked toxic character not absolutely prohibited. All packages to bear testimony to amount and name if any used.

As to colouring matters no maximum limit fixed. But it is well known that aniline dyes have a retarding effect on digestion. No colouring matter to be used unless each package bears testimony to name and amount. No absolute prohibition of any colouring matter which has no marked toxic character.

Extract from the report of the Secretary of Agriculture, U.S.A., to the President for the year ended June 30th, 1899.

Careful and systematic research has been made in the division of chemistry for preservatives of all kinds which may have been used on meats. The attitude which the department should take toward preservatives has been frequently outlined in official reports, but it may be as well to restate it here, as the matter is of great importance.

It is not regarded as a wise thing to absolutely prohibit the use of preservatives in foods. Since, however, all chemicals which have the properties of preserving foods have also a tendency to interfere with the processes of digestion, it is held to be imperative that no food should be offered for sale which contains a preservative without having this fact plainly stated upon the label of the package. Not only should the label state that the food product contains a preservative, but it should also give the name of the preservative and the quantity employed. In this way the intending purchaser is fully informed in regard to the character of the product which he buys. While it has been established that a healthy stomach can, from time to time, receive with impunity food containing small quantities of preservatives, it is by no means certain that the continued practice of ingesting preservatives in foods would not produce serious injury. On the other hand, it is also quite certain that weak or diseased stomachs may suffer temporary or permanent injury from minute quantities of preservatives.

The following are among the enactments in force in the State of Illinois bearing on the subject:—

Be it enacted by the people of the State of Illinois, represented in the General Assembly, that no person shall mix, colour, stain, or powder, or order or permit any other person in his or her employ to mix, colour, stain, or powder any article of food with any ingredient of material, so as to render the article injurious to health, or depreciate the value thereof, with intent that the same may be sold; and no person shall sell or offer for sale any such article so mied, coloured, stained, or powdered.

No person shall coat, powder, or colour with annatto or any colouring matter whatever, any substance designed as a substitute for butter, whereby such substitute or product so coloured or compounded shall be made to resemble butter, the product of the dairy.

Vinegar shall not Contain Lead, Copper, or Sulphuric Acid.—No person shall manufacture for sale, offer for sale, or have in his possession with intent to sell, any vinegar found upon test to contain any preparation of lead, copper, sulphuric acid, or other mineral acid, or other ingredients injurious to health. All packages containing vinegar shall be marked, stencilled, or branded on the head of the cask, barrel, or keg containing such vinegar, with the name and residence of the manufacturer or dealer, together with the brand required in Section 16 of this Act.

Canned Goods to be Free From Articles Deleterious to Health.—No packer or dealer in preserved or canned fruits and vegetables, or other articles of food, shall sell or offer for sale such canned or preserved fruits and vegetables or other articles of food, unless they shall be entirely free from substances or ingredients deleterious to health, and unless such articles bear a mark, stamp, brand, or label, bearing the name and address of the firm, person, or corporation that packs same or dealer that sells same. All soaked or bleached goods or goods put up from products dried before canning, shall be plainly marked, branded, stamped or labelled as such, with the words "soaked" or "bleached goods" in letters not less than two-line pica in size, showing the name of the article and name and address of the packer or dealer who sells same.

Fruits, Jellies, and Jam.—No person shall manufacture for sale, have in his possession with intent to sell, offer or expose for sale, or sell, as fruit, jelly, jam, or fruit butter, any jelly, jam, or imitation fruit butter, or other similar compound made or composed, in whole or in part, of glucose, dextrine, starch, or other substances, and coloured in imitation of fruit, jelly, jam or fruit butter; nor shall any such jelly, jam, or fruit butter or compound be manufactured or sold, or offered for sale, under any name, or designation whatever unless the same shall be composed entirely of ingredients not injurious to health; and every can, pail, or package of such jelly, jam, or butter sold in this State shall be distinctly and durably labelled "imitation fruit, jelly, jam, or butter," with the name and address of manufacturer or dealer who sells same.

All baking powders sold in the State must be labelled in a conspicuous way and place with a name signifying the class or variety to which it belongs, based on the name of the acid ingredient; thus, for example, "This is an alum baking powder; an alum phosphate baking powder; a phosphate baking powder; a cream of tartar baking powder." Potassium acid sulphite is regarded as unwholesome, if not injurious, and its use in any article of food is prohibited.

APPENDIX No. II.

LAW AND PRACTICE IN THE BRITISH COLONIES AS TO PRESERVATIVES AND COLOURING MATTERS IN FOOD.

(Summary of data obtained by the Colonial Office.)

AUSTRALIA:—

(1) South Australia.

Preservatives such as boracic acid, formalin, and salicylic acid are met with in dairy produce, and also colouring matters. Boracic acid is the predominating chemical substance used in this colony as a preservative, and it is invariably added as a component in a compound known as "Preservitas." The percentage of boracic acid contained in "Preservitas" is believed to exceed 70. Formalin and salicylic acid when put into milk and butter are regarded as of considerable danger to consumers. Colouring matters are used by all butter and cheese manufacturers, but when the preparations are of purely vegetable origin, little danger is apprehended from their presence.

The Dairy Instructor says that butter containing 1 per cent. of boracic acid is probably unsafe to the consumer. In this colony 8ozs. to the 100lbs. of butter is regarded as a safe and sufficient quantity.

Colouring matters are sold of varied strengths, so that a fixed proportion cannot be recommended. Law of 1882 is on the lines of the Tasmanian law of 1885 (*see later*), but there is a clause in the law of 1890 which declares that in the case of food which is a mixture, or which has an admixture of an ingredient or ingredients not generally known and recognised as a natural and necessary component part of that food, and is mixed therewith by way of adulterating it, or is an artificial imitation of an article of food, *a label shall*

Appendix.

be affixed to that food, specifying the names of each of the matters or ingredients with which such food is mixed or adulterated.

(2) QUEENSLAND.

Law of 1881 as in Tasmanian Act of 1885 (*see later*).

As to the legal aspect of the matter, the Attorney-General is not aware of any law in force in Queensland which expressly authorises the use of any matter in connection with food for the purpose of preserving and colouring the same, but that there are several Acts in force which provide for the punishment of persons who mix any colouring or other matter with any articles of food, which are deleterious or such as to render the article injurious to health.

The Under Secretary says that so far as agriculture is concerned the use of preservatives in Queensland is confined principally to butter and cheese. With regard to the former the use of certain preservatives is prevalent to some extent in dairies and creameries. The factories, too, in some instances, use preservatives again in the cream arriving at the creameries by rail, especially during the hot weather. These are commercially known as Preservitas, Sal Preservare, and Preservaline. There are others in use in a minor degree, but these are the principal and analyses of them as taken by the Agricultural Chemist show:—

Preservitas.

Water	H_2O	34·50	per cent.
Soda	Na_2O	5·58	„
Boric Acid	B_2O_5	47·39	„
Salt	NaCl	9·33	„
Saltpetre	KNO_3	3·00	„
		99·80	„

A mixture of 34 per cent. borax, 9 per cent. common salt, 3 per cent. saltpetre, the rest being boric acid.

Sal Preservare.

Water	H_2O	34·30	per cent.
Soda	Na_2O	4·96	„
Boric Acid	B_2O_5	51·80	„
Salt	NaCl	8·52	„
		99·58	„

A mixture of 30 per cent. borax, 8·5 salt, the rest being boric acid.

Preservaline.

Water	H_2O	37·70	per cent.
Boric Acid	B_2O_5	40·60	„
Salt	NaCl	20·16	„
Saltpetre	KNO_3	3·03	„
		101·49	„

A mixture of 20 per cent. common salt with 3 per cent. saltpetre and boric acid.

It is difficult to give an authoritative opinion upon the injurious effect of these preservatives, for no thorough investigation has been made in this direction. The danger would perhaps seem to lie rather in the misuse than the use, and it is the cheap chemicals that have to be feared most. The fact, however, remains that authorities upon dairies in Queensland (excluding manufacturers) are adverse to the use of preservatives.

To what extent and in what amounts they are used at the present time cannot be answered definitely, since no direct investigation has been made.

The Government analyst says that the law on the subject is included in sections 2 to 8 under heading "Description of offences" in the "Sale of Food and Drugs Act of 1881," these sections being identical with Sections 3 to 9 in the English "Sale of Food and Drugs Act of 1875," so that Queensland is in practically the same position as England in this matter So far as he is aware no prosecutions have taken place in Queensland for the use of preservatives in food, although, owing to the hot climate, preservatives are almost universally used.

The fact that some qualified medical practitioner can almost invariably be brought into court ready to swear to the harmlessness of preservatives, and that the general practice in such cases is to give the accused "the benefit of the doubt" owing to conflicting medical evidence, instead of giving the public the "benefit of the doubt," has prevented certificates from being issued as to preservatives being deleterious; and the lack of evidence has prevented the fixing of any standard as to the amounts of the various preservatives which should be considered injurious to health.

With regard to colouring matters the only prosecutions so far as known in Queensland were for the use of Roseaniline in wine, and a conviction was obtained in each case.

The public analyst of South Brisbane says that borax, boric acid, formalin, salicylic, and benzoic acids, are frequently found to have been added to articles of food as preservatives. In the summer months milk, butter, and cream, are kept for a considerable time by the addition of borax, boric acid, or mixtures of these two substances under various fanciful names, and formalin, although only recently introduced, is likely to be widely used for this purpose, as an addition of so small a quantity as 0·05 per cent. is sufficient to keep milk for weeks, and two or three drops to a pint will keep a sample fresh for two or three days. Benzoic, boric, and salicylic acids are also used for the preservation of potted meats and sausages, and in the curing of ham and bacon. Salicylic acid is sometimes added to jam as an antiseptic and preservative.

Queensland being a much hotter country than England, the more popular of these preservatives, principally borax and boric acid, are naturally used on a much larger scale, but no case of illness or indisposition caused by their use has yet been heard of, and it is considered that it would be very difficult to determine whether their addition is injurious or not (in the quantities used). It is held to be desirable that legislation should define the maximum amount of a preservative to be added, to prevent the possibility of an invalid or young child being given what might be medicinal doses.

Annatto, turmeric, saffron, and oil-soluble azo-aniline dyes are used for the colouring of butter and cheese. Those most popular are liquid annatto and oil-soluble anilines. A salt of copper, usually the sulphate, has been employed to render bottled fruits and vegetables a bright green colour. Cochineal, saffron, indigo, chlorophyll, and aniline dyes impart the various tints to articles of confectionery. Roseaniline, fuchsine, or magenta are used for jams and preserves. Turmeric and yellow aniline dyes bring up the colour of sugar. Red ferruginous earths, as bole Armenian, Venetian red, and Bismarck brown are occasionally added to sauces, sausages, and potted meats. Fuchsine, cochineal, logwood, beetroot, and alkanet have been detected in wines. Caramel or burnt sugar is very largely used for the colouring of spirits (brandy, rum, and whisky), and also for artificial vinegar.

Although the majority of the above colouring agents may be considered harmless, it will always be a question whether any may be present in sufficiently large quantities to be in any way injurious to the consumers' health. The non-poisonous colouring matters are some of the aniline dyes (*when pure and free from arsenic*), saffron, turmeric, annatto, chlorophyll, and generally any vegetable matter. In one or two cases of jam colouring the amount of roseaniline present has been sufficient to be decidedly injurious, especially as jam is an article largely consumed by children. With regard to vinegar it was, until recently, quite the exception to obtain a pure malt vinegar, the article usually sold being simply very dilute acetic acid, coloured with burnt sugar.

(3) VICTORIA.

Law of 1890 as in Tasmanian Act of 1885 (*see later*).

Law as to sale of spurious butter as in Western Australia (*next below*).

The Secretary for Agriculture says boric acid forms the base—in some cases the whole—of the many-named preservatives used in food. During the first export seasons, 1889-90, most of the butter was exported without boric acid; but butter in which one-half per cent. of preservative was added kept better and was more palatable and fit for consumption, and realised up to £5 per ton more. Numerous eperiments have been made during the past few years with a view of ascertaining if butter can be manufactured to stand the variations of temperature and length of time without deterioration before reaching the British consumers. The system of pasteurisation has been adopted in many of the factories with this object, with encouraging results. So far, even the pasteurised butter to which a little boric acid has been added has been found to keep better than that without it.

Mutton, beef, rabbits, and other meats exported, being frozen, do not contain any preserving material. In the spring and early summer months little or no colouring is used in butter or cheese. In autumn up to five ounces of annatto seed and olive-flavoured cotton seed oil colouring is added to 100 gallons of cream containing 45 per cent. of butter, and in cheese up to an ounce per 100 gallons of milk.

Dr. Springthorpe, physician to the Melbourne Hospital, and lecturer on therapeutics, dietetics, and hygiene at the Melbourne University, states on the subject of using preservatives in food: "As regards boric acid, I have some absolute evidence within actual defined limits. I have now for some years treated practically all my hospital typhoid patients on a diet of sterilised hopped malt extract with very satisfactory results from every point of view, and a very large number of cases have been similarly treated in Victoria, Queensland, Western Australia, and New Zealand, with similar results. My routine treatment for over three years has been to add 2½ grains of boric acid to the ounce of sterilised water to every meal of malt, usually twelve in twenty-four hours—that is, 30 grains of boric acid in the day—with intent and result of keeping the malt aseptic throughout its assimilation. Some 300 patients have been under my personal observation, taking 30 grains of boric acid daily for periods varying from one to six or nine weeks, and I have never noted any bad effects; on the contrary, the local condition of the intestine recovered its normal tone. The patients convalesced, as a rule, stronger rather than weaker than patients on ordinary milk."

(4) Western Australia.

But little done so far, in the absence of legislation.

Preservatives and colouring matters believed to be used in food to a very slight extent.

The law of 1898, on the lines of the Tasmanian law of 1885 (*see later*). The sale of spurious butter "with or without salt or other preservative and . . . . colouring matter" can only be carried on under a system of declaration.

BAHAMAS :—

No special local legislation. Practice does not obtain.

BARBADOS :—

Caramel (burnt sugar) is used for colouring rum, and cochineal or fuchsine in minute quantities for colouring sweetmeats made and sold in the colony. Careful enquiries failed to ascertain other instances of the use of preservatives or colouring matters in food of local manufacture.

BRITISH GUIANA :—

Law of 1892 prohibits the colouring or staining of food in a way to render it injurious to health (as in Article 1 of Malta law of 1888—*see later*).

Report by the Government Analyst says that both sugar and rum are artificially coloured. No preservatives are used in articles of food intended for export. The bulk of the sugar made is for export to the United States, and is not coloured. That sent to England is treated while in the vacuum pan with small quantities of a solution of stannous chloride (protochloride of tin, tin crystals, dyers' crystals) which results in the production of the yellow bloom characterised "Demerara crystals." The colour is really a modification of the natural colouring matter of the cane, and contains none of the stannous chloride. Investigations made many years ago proved that all but minute traces of the stannous chloride used pass into the residual molasses. Investigations made in England by Dr. Stevenson and other experts fully confirmed the results above mentioned, and further proved that the minute traces of tin retained by the sugar were physiologically inactive. A similar bloom or colour may be attained by the use of sulphuric acid, phosphoric acid, and various vegetable acids in the vacuum pan, but the results are not satisfactory or lasting. Attempts have been made to use certain aniline dyes in the place of stannous chloride, but have **proved failures**, and no sugar so coloured has been exported from the colony for many years past.

Rum is coloured with caramel or burnt sugar or molasses. The colouring matter is quite uninjurious. Attempts have been made to use aniline dyes in the place of caramel, but have all failed, and no rum has been exported from the colony for some years past so coloured.

Practically, therefore, the colouring of food stuffs is limited to the colouring of sugar intended for the English market by a modified form of the colouring matter natural to the cane and to the colouring of rum by caramel. Of the chemical agents used in the manufacture and colouring of sugar only physiologically inactive traces remain in the product.

BRITISH HONDURAS :—

No special local legislation. Practice does not obtain.

CANADA :—

The law does not prevent the use of preservatives and colouring matters in food unless they are injurious to health.

Law briefly as follows :—

Law of 1886, as amended in 1898.—Food is adulterated if it contain any added poisonous ingredient, or any ingredient which may render it injurious to the health of a person consuming it, or if it so coloured or coated or polished or powdered that damage is concealed, or if it is made to appear better or of greater value than it really is.

As regards the addition of non-injurious matter to food, the law of 1898 says that food is not adulterated: "If any matter or ingredient not injurious to health has been added to the food or drug because it is required for the production or preparation thereof as an article of commerce, *in a state fit for carriage or consumption* and not fraudulently to increase the bulk, weight, or measure of the food or drug, or to conceal the inferior quality thereof, if each package, roll, parcel, or vessel containing every such article manufactured, sold, or exposed for sale *is distinctly labelled as a mixture*, in conspicuous character, forming an inseparable part of the general label, which shall also bear the name and address of the manufacturer."

As to penalties for injurious adulteration of articles, the same law says that if such adulteration is within the meaning of this Act deemed to be injurious to health, for a first offence a penalty not exceeding 200 dollars and costs shall be incurred, or three months' imprisonment, or both, and for each subsequent offence a penalty not exceeding 500 dollars and costs, or six months' imprisonment, or both, and not less than 50 dollars and costs.

As to vinegar, the law of 1886 says that vinegar sold, or offered, or exposed for sale, shall be deemed to be adulterated in a manner injurious to health if any mineral acid has been added thereto, or if it contain any soluble salt having copper or lead as the base thereof—whether such mineral acid or sald is added either during the process of manufacture or subsequently.

As to liquors, it says that alcoholic, fermented, or other potable liquors sold, or offered, or exposed for sale, shall be deemed to have been adulterated in a manner injurious to health if they are found to contain any of the articles mentioned in the schedule to the Act, namely, cocculus indicus, chloride of sodium (otherwise common salt), copperas, opium, cayenne pepper, picric acid, salicylic acid, Indian hemp, strychnine, tobacco, darnel seed, extract of logwood, salts of zinc, copper or lead, alum, methyl alcohol and its derivatives, amyl alcohol, and any extract or compound of any of the above ingredients.

A form of warranty has also been enacted (in 1898) to the effect that articles manufactured by the vendor or by persons known to him are pure and unadulterated within the meaning of the Adulteration Act.

In actual practice it has been found that salicylic acid has been found in beer, condensed milk, and preserves, and borax in milk. Only salt used in butter. British importers have urged the use of preservatives, but Canadian manufacturers have not fallen into the practice. Annatto is used for colouring butter and cheese, but only in very minute quantities in cheese. Many baking powders also contain alum, and none of these have been declared by the Courts illegal. Salt only is used in curing bacon, which is sprinkled with borax when dry, for purposes of transit. No preservatives used in preserved fruits and jams. The Department of Inland Revenue at Ottawa is of opinion that salicylic acid in beers, etc., is injurious to health, and that alum in baking powders is not less so, but as yet the Courts have not determined the point.

CAPE OF GOOD HOPE:—

As regards butter, the addition of preservatives is seldom resorted to except in a few instances when butter im made for keeping purposes. In this case preservatives are usually added at the rate of 1 lb. to 100 lbs. of butter, the chief ingredient in the preservative being boracic acid. Colouring matter is as a rule only used in cheese making, and is added at the rate of 2 fluid ounces to every 100 gallons of milk. The colouring matter is generally a vegetable product and entirely harmless.

As regards wine, the only preservative generally and openly used in this Colony is alcohol in the form of spirits of wine, the maximum strength to which wines are thus fortified being 35 per cent. proof spirit. Other preservatives, if used to any extent, are applied secretly, and the only substance known of as being used in this manner is salicylic acid, which is added at the rate of 3 to 5 ounces per hogshead of 64 gallons.

With regard to butter, colouring matter is sometimes added, but it is doubted whether the practice of adding a preservative is in any extensive use.

It is very seldom necessary to use colouring matter in wine, the blending of different wines being resorted to to obtain the desired result. In the few cases where colouring matter is applied, the substance generally used —in small quantities, according to the depth of the colour required—is caramel. But colouring matter is frequently added to the red wines. Some time ago an attempt was made by a gentleman to induce the Government to adopt at the Government Wine Farm and to advocate the use by wine farmers of a certain preparation to be added to new-made wines. This preparation was found upon analysis to contain a considerable quantity of formaldehyde, upon which chemical the results obtained by the use of the preparation really depended, its effect being to arrest further fermentation, and therefore to ensure the keeping of the wine. Its use was reported against, and the preparation was therefore not taken up by the Government.

The use of formalin was also reported against in wines on the ground (a) that there is no definite knowledge of the action on the human system of the continuous consumption of formaldehyde, and (b) that physiologically the continuous use of a powerful disinfectant and irritant would injuriously affect the act of digestion, especially that portion of it dependent upon bacterial action.

Tumeric has been frequently found in mustard, and aniline colours at rare intervals in sugar; and bottled fruit from Australia has contained sulphurous acid.

Law of 1890 as in Tasmanian Act of 1885, but one clause says that if any person selling, offering, exposing, or keeping for sale any spirits, wine, malt, or other liquor, shall have upon his premises, or in his possession any vitriol cocculus indicus, nux vomica, tobacco or tobacco juice, pepper, chillies, opium, aloes, salts of zinc or lead, copperas, faba amara, logwood, or any extract or preparation thereof respectively, or any other poisonous or deleterious substance whatsoever, otherwise than for some innocent purpose, the proof of which shall lie on such person, he shall be liable to the penalties.

CEYLON:—

The only law at all touching the subject of preservatives is one clause of the Penal Code having reference to the sale of food or drink in a noxious or unfit state.

Materials known to be used in the Colony for preserving food are:—

Salt (chloride of sodium), for meat and fish.

Saltpetre (nitrate of potash), for meat.

Vinegar (acetum), for meat and fish.

"Hal" Bark (vateria acuminata), to preserve "Toddy" from acid fermentation.

Boracic acid, for preserving milk and butter.

"Goraka" (Garcinia cambogia) pericarp, used for preserving fish and also meat.

Tamarind (Tamarindicus Indica) pulp, for preserving fish.

Cinnamon (Cinnanum zeylanicuon), to prevent acid fermentation in preserves.

Pepper (Piper nigrum), to prevent fermentation in pickles. It is also used to preserve honey.

"Arrack" (Palm spirits), for preserving curried meat.

Lime and the bark of Vatirui Indica to retard fermentation when preparing jaggery from toddy.

The foregoing are the chief substances used for preserving food, and their use in any quantity whatever is not injurious to health.

The following are also used, though not so largely:—

Honey, for raw meat.

Glacialine, a preparation imported from England for meat. It is believed to contain borax in some form.

Cow ghee, for meat.

Materials known to be used for colouring food are:—

"Shoe Flower" (Hibiscus Rosa-sinensis), red, for colouring preserves and sweets.

Annatto (Bixia Orellana), orange yellow, for butter.

Sapan (Caesalpinia Sapan), red, for colouring boiled eggs and sweets.

Cochineal (Coccus Indicus), pink, for sweets, puddings, etc.

Spinach (Casella Alba), green, for sweets.

Turmeric (Curcumina Longa), yellow, for colouring rice and roasted gram.

Burnt sugar for colouring home-made wines.

The use of these materials in any quantity whatever is not injurious to health.

The following substances are also used:—

Magenta, which is considered poisonous in very small quantities for the preparation of sherbet.

Kolichayam, a chemical preparation commonly believed to contain arsenic. It is sold in small paper boxes, and consists of small grains—red, pink, and green in colour.

CYPRUS:—

No special local legislation. No preservative used other than salt.

FALKLAND ISLANDS:—

No food preservatised.

The "law of England" so far as applies to local circumstances is in force.

FIJI, GIBRALTAR, GOLD COAST:—

No special local legislation. Practice does not obtain.

HONG KONG:—

No preservatives other than common salt found, though sought for, and no colouring matters found, save caramel and magenta to a small extent in beverages. A certificate of adulteration would be given by the Government Analyst were a food such as cayenne pepper or mustard to be artificially coloured, or were a food to contain a preservative such as borax, boracic acid, and such like chemical substances, and there is but little doubt that on such a certificate the seller of the adulterated food would be convicted.

JAMAICA:—

Law of 1898 as in Malta, Art. I. of 1888. Local practice of use of preservatives and colouring matters wholly inappreciable in extent, and injurious ingredients do not appear to be used.

LAGOS:—

No special local legislation.

LEEWARD ISLANDS :—

No law in force. No attention has been given to the matter. Practically no use of preservatives or colouring matters, save alleged use of sulphate of copper at times in a domestic preparation of preserved lime peel.

MALTA :—

Law of 1859.—Art 1.—Food and drinks exposed for sale, may be seized for analysis as to admixtures of a kind injurious to health, under certain specified methods of procedure.

Art. 4.—If mixtures injurious to health are found, sentence shall follow. If not, payment for any damage sustained shall be made.

Law of 1888.—Art. 1.—Punishment by imprisonment to follow on sale of drinks or food mixed with substances to render them injurious to health, unless the vendor were ignorant of the mixture, and could not reasonably have been expected to know. In all cases the food, etc., is to be forfeited.

Art. 2.—Food and drinks in a state of decomposition injurious to health shall not be sold.

Law of 1893.—Art. 1.—The importation of food and drinks which might be injurious to health may be prohibited.

MAURITIUS :—

No preservative known. Only colouring known is one called locally "Golden Bloom," but rarely used, and not regarded as deleterious, but never analysed by the Government.

Penalty lies on sale of liquor containing any ingredient hurtful to health, under laws of 1838, 1869, and 1878.

NATAL :—

Law of 1898.—Byelaws, enforceable under penalties for contravention, may be made by town councils in regard of food containing a mixture, colouring, or powdering of injurious ingredients, so as to render the article injurious to health, and may prohibit the sale of any such food *if the fact be not declared.*

No reports under the Act have been made, as only two boroughs have at present (October, 1899) framed bye-laws.

NEWFOUNDLAND :—

No special local legislation. Practice does not obtain.

NEW ZEALAND :—

The law of 1898 stipulates as follows :—No person shall : (1) Mix with or add to dairy produce, or use in the manufacture thereof, any extraneous ingredient of any description ; nor (2) Manufacture any dairy produce from other than milk or cream ; nor (3) Knowingly sell any such produce. Provided that, except in so far as is otherwise provided by regulations under this Act, nothing in this section contained shall be construed to prevent pure sugar, common salt, or any harmless coagulative, preservative, or colouring ingredient or constituent being used in the manufacture of dairy produce.

The Governor may from time to time, by Order in Council gazetted, make regulations consistent with the provisions of this Act, for preventing or limiting the use of preservatives or other ingredients in the manufacture of dairy produce.

It is the practice among cheese manufacturers in New Zealand to use at times a small quantity of a solution of annatto (1oz. to 100gals. of milk) for the purpose of colouring the cheese. It is the same material as that which is used by cheese makers in all countries. New Zealand cheese is free from preservatives of any kind. The butter manufacturers occasionally put some colouring matter in their butter, employing for the purpose the same substance as is used in cheese making, prepared in a different manner, but quite as harmless.

Preservatives, known by such trade names as "Preservative," "Preservitas," etc., are used at some of the butter factories to the extent of $\frac{1}{8}$ to $\frac{1}{4}$ of a lb. to 100lbs. of butter.

It is forbidden to sell milk that has not been properly cooled immediately after having been drawn. And no person shall sell other than "pure milk" without declaration, "pure milk" being milk which does not contain "any preservative of chemical or colouring matter of any kind whatsoever."

NIGER COAST PROTECTORATE :—

No special local legislation.

ST. HELENA :—

No trade in which colouring matters are used.

ST. VINCENT :—

No special local legislation.

SEYCHELLES, SIERRA LEONE :—

No special local legislation. Practice does not obtain.

STRAITS SETTLEMENTS :—

No law in force. Only exported food is tinned fruits, placed in flavouring syrups. No preservative or colouring matter is added.

Chinese and other nations use a dark red dye imported from China for colouring cakes, and extract from certain leaves a deep green dye for cakes and sweetmeats. Both are said to be harmless. Cooks often use the flower of the hibiscus to give a red colouring to syrups and sauces, an artifice said to be harmless. There is no reason to believe that the use of injurious preservatives or colouring matters prevails to any extent.

TASMANIA :—

The practice has been to order proceedings to be taken in all cases where the Government analyst reports that the matters used are in themselves deleterious or are present in quantities injurious to health. Where the matters are innocuous, and only reduce the commercial value of the article adulterated, the Board leaves it to the persons prejudiced to take action.

The law of 1885 renders penal, except in cases of proved absence of knowledge which could reasonably have been obtained, the mixing, colouring, or powdering of food with any ingredient or material so as to render the article injurious to health ; but declaration by label of the addition of non-injurious material protects the vendor, and the addition of non-injurious substances necessary to the preparation of an article in a fit state for carriage is allowed, if they do not fraudulently conceal inferiority of quality.

TRINIDAD :—

Law of 1881 forbids sale of intoxicating liquors mixed with, or storage on licensed premises in the absence of satisfactory reason of, cocculus indicus, chloride of sodium, copperas, salts of zinc or lead, alum, sulphuric acid, or any extract or compound of any of these articles, which may be added to by Order.

Law of 1895 as in Malta, Art. I. of 1888. (*See Ante.*) Preserved peas used to have 3 grains of copper per lb. Proceedings eight years ago led to reduction of quantity added to from $\frac{1}{4}$ to 1 grain per lb.

Wines of low alcoholic strength sometimes contain small proportions of salicylic acid.

Butter is coloured with annatto, and some, principally French, contains 27 per cent. of salt.

(All the above are imported goods.)

Locally, milk contains no preservative, and rum is coloured with caramel solution.

Recently proceedings have ceased in view of the difficulty of proving that preservatives as used are injurious at a single meal.

WINDWARD ISLANDS :—

(1) St. Lucia.

No law deemed necessary. Only sugar is coloured with a matter commercially known as "bloomer" for sugar called "yellow crystals," and then only in amount not considered likely to be injurious to health.

(2) Grenada.

No law in force.

Only substances used are annatto (milk and sweetmeats), prickly pear (sweetmeats), and burnt sugar (new rum). None of these regarded as injurious to health.

Appendix.

APPENDIX No. III.

REPORT on Visit paid to AMSTERDAM, HAMBURG, and DENMARK in relation to the use of Chemical Preservatives in Milk and Butter.

When the Food Preservatives Committee had been taking evidence for some few months, it become increasingly apparent that a visit to Denmark, as a great butter-exporting country, wherein the use of certain chemical preservatives was prohibited, and to Ireland, as a butter-producing country, wherein such preservatives were largely employed, would be desirable before the verdict of the Committee was arrived at. It was finally decided that such visits should be made, and it was deemed important that the heat of summer should be chosen as best suited to a correct estimation of the difficulties to be met in the manipulation, storage, and transport of butter unaided by chemical ingredients of a specially preservative character. It was the more desirable to examine the Danish methods, owing to the fact that some useful information might, it was thought, be obtained with regard to the milk supply, the use of chemical preservatives in milk being prohibited in that country, and pasteurisation being at times resorted to.

Accordingly August and September were arranged for, the first for the Danish visit, and the second for the visit to Ireland. Unfortunately, the engagements of the Committee were such as precluded the presence of the chairman and other two of their number in Denmark, and hence we alone were in a position to proceed; but in view of the importance of heat as a factor in the programme set forth, it was decided that we should carry out the original scheme. It is satisfactory to be able to record that the weather throughout our stay on the Continent was hot and dry.

In addition to the facts which we chronicle in this report, we obtained certain information on matters other than milk and butter supplies, but of too piecemeal a character to warrant our setting it forth, touching as it does on the bacon industry, the egg and fish trades, the general question of preservatives in food, and such other subjects as the slaughtering of cattle and swine, and the transport of meat. Our time was far too restricted to admit of anything approaching a grasp of the numerous points of interest on matters analogous to our specific subjects, and hence, while we were glad to learn what we could, we cannot pretend to the same intimacy with these other questions as with those dealt with in the succeeding pages.

Before proceeding to the Continent we secured the assistance of the Foreign Office in the direction of special passports and introductions, and from Mr. Harald Faber, F.C.S., the Commissioner of the Agricultural Department of the Danish Government in London, who had already tendered evidence before the Committee, we obtained a number of valuable introductions, including the following, viz.:—

Hr. L. E. WULFF, Chief of the Department of the Ministry of Agriculture.

Prof. V. STORCH, Director of the Royal Laboratory for Agricultural Research.

Hr. B. BOGGILD, consulting dairy expert to the Royal Agricultural Society of Denmark.

The three leading milk companies in Copenhagen, viz.:—

"Copenhagen Milk Supply" (Director, Hr. G. Busck).

"The Milk Supply Pasteur" (Director, Hr. E. Krohn); and

"Det danske Maelke Compagni," System Cassé (Director, Hr. Salicath).

The Hon Alan Johnstone, H.M. Ambassador at Copenhagen, was unfortunately absent in England, at the date of our visit, but from Captain Boyle and Mr. C. Holger Funch, of H.M. Consulate, we obtained much help, as from all who are named in the above list, and many others who find mention in this report. We were, indeed, most kindly received on all sides, and no little time and trouble were taken to furnish us with the fullest information available.

Nor does this apply to Denmark only, but also to Amsterdam and Hamburg, at each of which cities we spent a day on our outward route, and learnt something of the milk supplies of both.

In what follows we do little more than reproduce the notes which were taken at the time as to that which we saw and were told, deeming it best to limit ourselves thus rather than to comment on or attempt to criticise all of the numerous phases of trade and practice coming beneath our notice.

AMSTERDAM.

We had the misfortune to visit Amsterdam during the absence of Dr. Ringeling, the Health Officer of the City, but we were happy in finding in his place Dr. J. W. Jenny Weigerman, the Assistant Health Officer, to whose great kindness we owe all that we have learned respecting the milk supply of the city and the subject of the chemical preservation of food. To the Mayor and the members of the Municipality we are also greatly indebted for the kind hospitality extended to us in our inquiry.

In addition to Dr. Jenny Weigerman, we were afforded an opportunity of conference with Dr. Reicher the City Analyst, and with the Director of the Fabriek voor Gesteriliseerde Melk, Amsterdam, from whom we obtained much useful and interesting information.

As is well known, Amsterdam, a city of over half-a-million people, is situate on the Ij, one of the ramifications of the Zuider Zee, while the River Amstel, which is here navigable, passes through the middle of the town on its way to the Ij. The city is for the greater part surrounded by pasture land, which affords good grazing for milch cattle.

The milk supply to the city may be broadly divided into three sections, namely:—

(1.) Pasteurised milk.
(2.) Sterilised milk.
(3.) Raw milk.

But before proceeding to speak of these supplies we may perhaps make brief reference to the law, and to the facts forthcoming, as to the use of preservatives in food.

The current law enacts that vendors of foods, drinks, or drugs, who, knowing them to be "falsified," shall sell them without declaration as to their actual nature, shall be liable to three years' imprisonment.

As a routine precaution, and apart from special analyses, the milk supplies of the city are tested twice in each year, though we did not learn that the samples of each source are examined for added chemical preservatives. Milk has, however, in the past been analysed *quâ* such admixtures, for boracic acid, formaldehyde, salicylic acid, benzoic acid, and fluoride of sodium, and as a matter of fact boracic acid has never been found in milk supplied to the city. Indeed, on only two occasions has a chemical preservative been detected, butter-milk alone being then in question, and formaldehyde the preserving agent.

It may be added that no chemical preservatives other than salt have ever been found in butter analysed in the city.

As regards the sterilisation and pasteurisation of milk, we were enabled to see something of the actual operations of the Fabriek voor Gesteriliseerde Melk "Amsterdam."

This establishment has laid down conditions on fulfilment of which alone milk will be received from the farmers who contract to send in their produce. Thus the milk sent must be from cows owned by the contractors; it must be pure, unadulterated, uncreamed, sweet to taste, and in other ways up to a certain standard. The evening milk that comes directly to the establishment must be cooled (milking is at 2 a.m. and 2 p.m.), and screened at the farm. The udders of the cows must be cleansed immediately prior to the operation of milking, and the milk of cows milked in the stalls in winter must be forthwith taken from the sheds to a cool chamber. All milk must be similar in constitution to the sample taken in the presence of the farmer by the director for examination by the analyst of the establishment. The results of such examinations are to be final both as to such sample, and as to those taken each day from one and another farm's supply for purposes of testing. The milk of every newly-added cow at a farm must be analysed by the same expert before her milk can be accepted. Milk from such cows must be sent in separately; it is paid for, but not used. The veterinary surgeon employed by the firm has power to veto any milk supply. Notification of infectious disease at a contracting farm is compulsory, but the exact reason for this is not at once apparent, since milk for an infected farm would, we gathered, be used, owing to the fact that no danger to the public health could arise in consequence of the pasteurisation or sterilisation of all milk received.

On receipt at the premises in Amsterdam the milk is at once screened, and then raised to a temperature of 30deg. C. (86deg. F.), in order to facilitate the centrifugalising process which follows. The milk and cream thus separated are then brought together again and intimately mixed by a series of revolving rollers. In the process of centrifugalising there is left behind on the inside of the separator the usual residue, which consists of a viscous-looking mass of a slimy, objectionable appearance. It contains much debris such as hair, inorganic mud, and other substances which have not been arrested in the preliminary strainings; indeed, separation may be rightly regarded as possessing very material cleansing properties. The residue however, consists mainly of caseous matter, and, as has been experimentally demonstrated, it contains numerous bacteria.*

After re-mixing the separated milk and cream, the whole milk is pasteurised, *i.e.*, it is led into litre (1·76 pint) bottles and raised during a period of twenty minutes, to 75deg. C. (167deg. F.), at which temperature it is left for the space of half an hour. The milk is then, with a view to destroy any approach to a "cooked" flavour which might otherwise result, at once cooled down to and kept at 11deg C. (52deg. F.), until sent out.

All separated milk sold as such is also pasteurised in the same way, and it is said to be much sought after by the poorer classes. Some of it goes back to farmers for the feeding of calves.

Pasteurisation has been practised in the city during the last ten years, and in Dr. Jenny Weigerman's opinion much reduction in the infantile mortality of Amsterdam has thereby resulted. Moreover, milk-borne outbreaks of enteric fever are now less frequent than heretofore, a result Dr. Weigerman attributes to pasteurisation rather than to other sanitary improvements, the Health Department having been at pains to exclude other possible factors in arriving at this conclusion. Children take kindly to the milk, that intended for their use being put up in bottles in quantities sufficing only for one meal; thus ensuring clean receptacles at each time of feeding; in fact, the operations now in question bear some relation to those of the "Goutte de lait" Society which has for some time been at work in certain parts of France, and which claims to have brought about a material reduction in the infantile mortality of the localities concerned. The Health Department were unable to state the proportion of the population consuming pasteurised milk; but the director of the Fabriek "Amsterdam" estimates that three-fourths of the total population are taking milk that is either pasteurised or sterilised, his firm alone selling three bottles of the first to each one of the latter for town consumption. The firm sends out 6,000 pints (in 3,000 quart bottles) daily, exclusive of milk exported in a sterilised condition for purposes of shipping companies and the like.

Milk about to be sterilised is, after being placed into open bottles, transferred to an autoclave containing cold water, the temperature of which is gradually raised by means of steam to 90deg. C., the air contained in the bottles being thereby expelled. At this point the glass rubbed-banded stoppers are firmly pressed home by a strong wire attachment, the lid of the autoclave is screwed down, and the contained water raised to and kept at 105deg. C. (221deg. F.) for twenty minutes. The milk is then cooled down to 40deg. C. (105deg. F.). Cold water is next let into the previously emptied autoclave, and the temperature of the milk finally reduced to 11deg. C. (52deg. F.), before being sent out in the ordinary way to the city, or exported.

We saw some sterilised milk which was bottled in 1884, and which it was declared was still good. It is not, of course, claimed for such milk that it will keep any longer than ordinary sweet milk when once a bottle has been opened.

No medical objection has been raised to the use of sterilised milk in Amsterdam. Indeed, the medical faculty have shown approval of its use. Much sterilised milk is issued to steamship companies, and keeps sound during voyages of three-and-a-half months' duration, even when the Equator is crossed and recrossed.

Great attention is paid to the cleansing of utensils at the establishment in question. The farmers' cans are cleansed in water heated by the injection of steam, each farmer having his own cans, which are always returned to him. He is forbidden to do anything with the cans himself in the way of cleansing.* The vessels used in the establishment are treated in similar fashion, and the milk bottles returned by customers for refilling are cleansed with warm water, by revolving brushes applied to the interior, and finally by steam injected into the inverted bottles. The rubber bands of the stoppers are sterilised separately (one customer gets milk with ordinary corks to the bottles by his own desire).

There are in the city thirteen firms which distribute only pasteurised milk; but there is also a considerable amount of milk sold in a raw state by small vendors. We were, however, much struck by the large extent to which pasteurised and sterilised milk was exposed for sale in Amsterdam, even in the poorest parts of the city.

As illustrative of the hold which such methods of treating milk have obtained in the city, it may be mentioned that we saw one little shop in quite a poor quarter with a notice in the window to the effect that the milk there sold was "free from bacteria."

The Copenhagen system of treating milk by cooling, filtration, and bottling only ("Busck" method) was stated to have failed, financially speaking, in Amsterdam. We learned no particulars of the experiment.

Milk reaches the city by road or by water, from both sides of the River Amstel. It is sent in at once after being drawn, some of it coming a journey of two hours by road. One large firm had to discontinue bringing milk into the city by road for distribution after simply cooling it, owing, it is said, to the liability of the milk to become partly churned, and hence not available for distribution.

Delivery of milk is made twice daily to houses. It is seventeen hours old when first sent out from the Fabriek "Amsterdam."

No great outlay had been incurred in establishment expenses at the Fabriek "Amsterdam." The whole premises were scrupulously clean, and the floors cemented. The workpeople nearly all wear wooden shoes, the floors being here (as in almost all such premises seen elsewhere) running with water, alike in receiving, heating, cooling, bottling, and cleaning chambers.

Pasteurised cream is exported by the firm for American lines of steamships, etc. No clotted cream is made. Fresh cream is supplied to the city, without the use of any chemical preservatives. Cream intended for the manufacture of butter for immediate consumption is not pasteurised. All cream used for making export butter is, however, pasteurised.

The price for pasteurised and sterilised milk is 10 cents (2d.) per litre (·76 pint) bottle; the ordinary raw milk sold by the farmers and small vendors (not in bottle) is 8 cents per litre. Customers of the pasteurised milk pay 3d. for the use of the bottles pending their return, but this really affects only chance customers, since, having once paid for a bottle, householders regularly supplied are liable to no further charges in this respect, empty bottles being collected as a routine matter when filled ones are delivered.

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* *Slime such as is here in question has been found crowded with tubercle bacilli, and in Denmark and in some other countries, with the view of limiting the spread of tuberculosis, such slime is ordered to be burned to prevent pigs from being fed thereon.*

* *As a general rule, and apart from the usage of this establishment, the big farms sterilise their own churns, but this is not the case in the small farms. It may be said in this connexion that the water supply of many farms is still regarded as bad by the Health Department.*

Appendix

The firm named could, they informed us, export sterilised milk to London, including charge for freightage, delivery in London, cost of bottles, and return of empties, at an inclusive cost much below that now paid by consumers of sterilised milk sent out by London dairymen.

It was abundantly evident to us that much attention has been given to the question of the milk supply of Amsterdam alike by the Municipal Health Authorities and the leading firms. It would seem to be but a matter of time, and that a brief one, for the supply of the city to be brought into the hands of such firms in its entirety, unless smaller vendors adopt methods akin to those now in vogue in the thirteen establishments to which we have referred. We were much struck by the small compass within which the Fabriek "Amsterdam" carries on its daily work, and which, in our estimation, makes it practicable for any small co-operation of milk vendors, under circumstances such as obtain in Amsterdam, to set up a plant of a like character with very fair return for capital outlaid. So far as we could learn, all firms of the sort here described are paying well, and, since the trade in such treated milk is growing, it would seem feasible to expect that not long hence Amsterdam will be a large city practically supplied with pasteurised (or sterilised) milk alone. Any difficulty which may lie in the way of furnishing such minute quantities of milk as are purchased by the extremely poor could perhaps be met by some method of distribution apart from bottles, which would enable very small quantities of treated milk to be sold over the counter in the same way as now obtains.

HAMBURG.

As our route from England to Denmark took us by way of Hamburg, a state of some 700,000 population, we were glad to have the opportunity, which was kindly afforded us by Dr. Reincke, the State Health Officer, of discussing with him the question of food preservation and colouring in the city. Not only did Dr. Reincke place himself at our disposal, but he also introduced us to the expert officers in the Municipal Laboratories, who were good enough to afford us much useful information as to the extent to which preservatives and colouring matters were detected in Hamburg by laboratory research.

There is at present no State control of farms or farm produce outside the city boundary. In the city itself there is a central office charged with the supervision of all kinds of food, and its officers have powers of entry on business premises. As regards farms beyond the city limits, the municipal authorities hope soon to bring about a form of voluntary control of the dairying operations, farmers in a large and increasing number of instances having expressed their willingness to abide by the city bye-laws and regulations, and thus to secure registration as suppliers of dairy produce under veterinary inspection by the State. In the city, the owner of a dairy or of a milk shop is obliged to notify the occurrence of sickness in his family or among his servants, and persons themselves ill with infectious disease, or having been in contact with infection, are not permitted to take any part in the handling of milk. In the case of a shop, its closure is the alternative to removal of the patient to hospital. As to cow owners in the city, it is laid down that they must ensure cleanliness of the hands of milkers and of the udders of cows. The sheds must be provided with good drainage arrangements, and milk cans must be cleansed with boiling water. The whole milk traffic of the city is under control by a State veterinary surgeon, but there is no compulsory examination of cows on account of tuberculosis.

The city has not been without reminders of the need for attention to its milk service, since several outbreaks of enteric fever have been traced to the agency of milk during the past few years. Three years ago fifty cases were found to have their source in the milk of one vendor.

The farms on the marshes around Hamburg are not well supplied with water, and it is feared that dairying utensils may be washed at times with indifferent water. In general, the farms derive their supply from the river, there being much iron in the marsh water.

Good pasture is common on the marshes close at hand, though but few cows are to be found on such marsh land as is actually within the city boundary. Milk, which is delivered twice daily, comes into the town by rail and river as well as by road. There are no special railway waggons for the short distances that milk travels by rail. The German railroad stations have no raised platforms, and hence large churns such as are common in England would be difficult to deal with. Fifteen German miles (sixty-nine English) is the maximum distance which milk travels to Hamburg, and this is performed by water or by rail. The general facilities as to proximity and transit are such that milk is only twelve hours old when delivered to houses in the city.

Milk is much watered in the town, and of each average 100 samples which are found to be unsatisfactory, 24 are watered, the amount of dilution being from 10 to 14 per cent. of added water.

The law (Hamburg Mark Law) in force in the State forbids the sale of milk mixed with water or any other foreign matter, including all kinds of preservatives. The detection of preservatives leads to the punishment of the vendor. As a matter of fact, preservatives are seldom found in milk. The law against them was enacted in 1894. Prior to that date milk was not examined for preservatives, but the effects of the enactment in question may be judged from the fact that in 1895 as many as 23 per cent. of samples examined contained boracic acid, in 1896 14·5 per cent., while in 1897, of 2,422 samples tested, 118 (less than 5 per cent.) yielded boracic acid, the preservatives being used mainly from June to September, and the skimmed milk samples being those most commonly preserved. Occasionally now, in summer, 22 per cent. of tested samples are boracised, but in the winter months only 1 to 3 per cent. Formerly from 2 to 3 per cent. of samples contained formaldehyde, now none is detected. Milk is not now examined as a matter of routine for benzoic acid or salicylic acid, but these chemicals were never found in the past. Preservatives are not used at the farms, but only by the middlemen, and it is thought that the use of preservatised milk is not confined to any one class of the population. The Hamburg law affects only the State of that name. Regulations vary considerably in the different states and towns of the German Empire.

As regards butter, boracic acid has only been found on two occasions in samples examined in the laboratories. On both instances the article was blended butter. Probably the preservative had been added in Hamburg. Some 1,000 to 1,500 samples of butter are annually examined, though not all of them for preservatives. There is no law affecting the chemical preservation of imported butter.

Margarine samples are preservatised to the extent of some 50 per cent. of their number, the addition consisting of from one to three per cent. of borax and boracic acid. Such addition is not an offence against the law. The preservative can, it is alleged, be tasted when present to the extent of 3 per cent.

Generally, the use of preservatives, save for milk, is thought to be increasing in the city. No definite pronouncement as to their harmfulness has been made by the medical faculty; but there is a consensus of opinion that they should be prohibited.

The cooling of milk is largely practised by farmers, good ice being cheap. Pasteurising of milk intended for butter-making, as well as that for consumption, is carried out by some farmers, and the milk again cooled down. These farmers are all outside the city limits and control, but they are becoming increasingly numerous, and the pasteurisation or sterilisation of all milk is said to be growing in favour with them.

In the city itself, the extent to which milk is pasteurised or sterilised is small. There is no general objection to the use of sterilised milk in Hamburg by the medical profession; but some medical men think that children fed on such milk have not thrived as well as children fed on raw milk. Dr. Reincke when in private practice shared this impression.

Most of the milk sold in the city is in a raw state; although boiled milk can be had if asked for at cafés, restaurants, hotels, etc. The greater part of the population boil the milk received into their houses; especially has this practice become general since the cholera epidemic of 1892.

Pasteurisation of milk is not regarded by Dr. Reincke as essential to a good milk service for Hamburg. He deems the "Busck" system at Copenhagen to be preferable.

No law has yet been enacted in the State on the subject of colouring matters in food. No arsenical colours are used.

DENMARK.

Danish Co-operative Dairy System.

Denmark is a country of co-operative dairy societies, there being at least three hundred such as the one at Hasley, which we describe later. The country has laid itself out to perfect its butter manufacture, as a national industry, and the local exhibitions held all over the State in furtherance of the butter trade are aided by the Government. No State aid is, however, afforded to small farmers in need of capital for outlay on their business, but money can be borrowed at a low rate of interest from local banks, some of which belong to large co-operative societies. The central creameries draw milk from an average radius of six miles, and the farmers (who are members of the society to whose creamery they send their produce) are paid according to the amount and the quality of the milk sent in. Government inspectors are employed to take samples of separated milk on its way from the creamery to the farm for cattle food, in order to ascertain that the law which requires that all milk used as food for cattle shall be duly pasteurised has been carried out.

In the island of Zeeland there are 400 parishes under local government, and nearly all possess regulations affecting the conduct of the dairying industry.

Hr. Boggild, consulting expert to the Royal Agricultural Society of Denmark, was good enough to give us his views on the subjects of butter manufacture and storage. He is of opinion that some 50 per cent. of the added salt is lost in the processes of working[*] (an opinion in which Professor Storch, Director of the Royal Laboratory for Agricultural Research, concurs), and he believes that 90 per cent. can be thus expressed. The salt used does not, in his view, much aid the keeping properties of butter, though the retention of 3, and still more so of 5, per cent. would not be without some influence in this direction. Twenty years ago salt was used as a preservative, but from 10-15 per cent. was then added. Nowadays dealers add salt to suit particular local demands, and a large amount of that added is lost in the second working. Professor Storch thinks that with the methods now in vogue some 1·8 to 2·5 per cent. of salt remains in the finished article. The buttermilk running from the salted article is too salt for use by cattle, but the milk from the earlier (unsalted) working is good for food. There is no difficulty in sending absolutely fresh butter to England since it will keep many days, say a week, and still retain its quality. For the keeping of butter in Denmark there are in many places store-houses having ice holds beneath them, in order to cool the air. Hr. Boggild states that butter leaving Denmark contains from 12-15 per cent. of water.

As regards milk, he thinks ice is necessary to the supply of large towns if delivery be only once daily, but not so if milk be sent in twice a day, and is cooled down immediately after milking, scrupulous cleanliness being also, of course, observed. Nor is it necessary to cool evening milk if it be dispatched at once by rail for a journey of not more than two or three hours, provided such milk is always strained at the farms. Where ice is used, it is common to have a store-house large enough to admit of two years' supply, so that the occurrence of a single mild winter now and again will not place the dealer or manufacturer in difficulties. Some farmers store snow, but it is not easy to do so.

Hr. Boggild looks upon the English churns as better suited for transport of milk than the smaller cans used in Denmark; but the absence of platforms at railway stations forbids their use in that country on account of their great weight and the consequent difficulty of manipulation. He thinks the cans now generally used in Denmark are admirably adapted for purposes of cleansing, as there are no sharp or hidden angles, every part of the can being visible and accessible from the mouth.

Lime water, hot or cold, he judges to be best for use in the cleansing of milk cans, etc. All such cleansing is supposed to be completed with water that has been boiled.

Some butter, if it just misses the Thursday boats, may be a week old on leaving Copenhagen for this country. Its average age in four days when put on the Scotch markets. Professor Storch states that though some butter is sent to England quite fresh, the quantity is not great.

MARGARINE.

Butter fat to the extent of 10 per cent. only is allowed in margarine. The public can tell the difference between butter and margarine by the colour laid down by law, and the margarine can be sold only when made up in special shape and labelled. Its sale as butter renders the vendor liable to penalty.

SANITARY STATE OF FARMS.

Most local authorities have framed regulations under the law of March 28th, 1868, forbidding the accumulation of dung in the vicinity of farm wells. Local regulations provide for the protection of private or public pumps against damage, and all drainage from the dung heap and stables must be prevented from reaching the water supply. The farm drains must remove all liquid filth, and pumps must be covered and protected against access of surface water. The immediate surroundings of all pumps must be raised above the level of the adjacent ground.

Professor Schou, of the Ministry of Agriculture, and one of the Government District Dairy Inspectors, was kind enough to accompany us and to afford us much valuable assistance in a visit to some dairy farms in the neighbourhood of Lyngby and Holte, some little distance north of Copenhagen, and we herewith furnish our notes relative to three of the farms visited.

(1) A cowshed at a small farm has three doors and two small windows. It has a cobbled floor, except in rear of cows' standings. Spaces are allotted so as to stall 14 cows, and the dimensions are 30ft. by 15ft. by 10ft. high, yielding 320 cubic feet per cow. But only one cow is now kept, her produce being used on the premises; the storage of ice is not considered necessary.

(2) A cowshed at a small farm, having no through ventilation, but aërial communication of cowhouse, stables, and piggery. Spaces allocated for 20 cows, and dimensions of shed 60ft. by 16½ft. by 11ft. high, giving 545 cubic feet per cow. But only two cows are kept; their milk is all used at the farm, and no icehouse has been erected. The shed is whitewashed once a year.

(3) A larger dairy farm, typical, we were told, of many in the country, though many others are inferior. The cowshed is well designed, for 38 cows, and is 77ft. by 33ft. by 13ft. high, affording 870 cubic feet per cow. But only 32 cows are kept. It has six windows in the roof, all opening well; two doors at one end, and one large door at the other end. The heads of each double row of cows would be at least 3ft. apart. Liquid filth can at once drain away into the yard, and be pumped thence direct on to the fields. There is an ice house, with a wooden roof covered with thick felt. The dairy is under the living house. Butter and cheese are made. No cooling apparatus has been set up as all milk is made into butter and cheese. The water supply is from a well in a meadow close at hand, whence it is piped to the house and farm buildings.

We visited during our stay a variety of cowhouses, both great and small, and the general conclusion at which we arrived was that the Danes possess a somewhat higher estimate of the value of cleanliness in the cowhouse than, according to our experience, is possessed in this country. Still, we wish to state plainly that we saw nothing in this particular alone which is not frequently attained to in England, and which, by the exercise of more care and intelligence, could not be reached in many more instances—in a word it was not the superiority of the Danish cowhouses which impressed itself upon us so much as the intelligent manner in which the Danes make use of the often humble facilities at their disposal.

STATE CONTROL.

The Police Master of Copenhagen may direct his colleague in any locality from which milk suspected of having caused disease, may have come to examine the cows and premises, and to endeavour to trace the source of origin of the outbreak. If there be illness among the cows, the milk must not be sold, and if infectious sickness be discovered in the families of those associated with the dairying, proper steps must be taken to ensure freedom from all danger of the further transmission of infection.

Professor Storch and his staff at the Government Laboratory deal with 15,000 to 16,000 samples of food every year, including skimmed milk, butter milk, butter, and a few samples of whole milk.

The bacterial cultures for us as butter starters which are made in the State Laboratory approach as nearly as practicable to "pure cultures." The vast majority of Danish butter is made by the aid of such cultures.

Salt is the only preservative which is allowed to be used for dairying produce or margarine.

Professor Schou is of opinion that no need exists for the use of chemical preservatives other than salt in butter, or salt and saltpetre in bacon.

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[*] This view is largely shared by all dairy experts (*see* the "Book of the Dairy" by Professor Fleischmann)

Appendix.

The use of colouring in milk is forbidden, but is allowed in butter and cheese. The colouring of margarine is specially regulated, to admit of its ready detection, its conformation and labelling, as already stated, being also regulated with a like object. The use of arsenical colours or aniline colours prepared with arsenic is prohibited.*

In Copenhagen most milk is still sold by small vendors. Some two-fifths of the population are believed to be supplied by large companies, using special measures of cooling and cleanliness, pasteurisation or sterilisation; that is, some 160,000 of the 400,000 people in the city are thus supplied. Much milk is boiled in the houses. It is a cheap commodity in Denmark, being only 15 or 16 ore (2d. per litre (about 1¾ pint).

The attitude of the State in respect of the dairying industry may perhaps be regarded as consisting more in the *encouragement* of the industry than in its control by legal enactments, and an illustration of this attitude will be found in the section dealing with the control of tuberculosis in cattle.

This same spirit of helpfulness is apparent in the transactions of the "Dairyman's Association," to the expenses connected with which the State makes a substantial annual contribution. This association, which consists of a large number of the largest Danish creameries, encourages the growth of knowledge with regard to dairying by holding exhibitions of butter in Copenhagen at frequent intervals. The butter-makers in the country generally, some at one time, some at another, are suddenly apprised of the fact that an exhibition is about to be held, and they are invited to despatch forthwith a cask of butter, together with sundry detailed information with regard to its manufacture, such as the amount of salt used, whether or not the cream was pasteurised, and how far use may have been made of pure cultures. The suddenness of the appeal has the object of preventing special butters being made for the occasion. The butters are received into a cold room, and at the end of two days are examined by experts selected by the association. The casks are so arranged as to furnish no clue as to the owner of the butter or as to its source, a number alone distinguishing one sample of butter from another. At the end of the trial the numbers attached to the butter, together with the marks given, are published, each owner being thus informed of the opinion come to as regards his own butter alone. The information obtained at these butter trials is recorded by the association, and put to such uses as seem expedient for the promotion of the industry.

CATTLE.

The milch cattle are mostly of the red Danish breed, but in Jutland the Jutland breed is well represented They are tethered in the fields by chains of some 12ft. long, with a 3ft. iron staple to fasten in the ground by means of a mallet. They seldom drag their tethers, save under circumstances of great fear, *e.g.*, at times of heavy thunderstorms or after very excessive rain. The cows are moved seven times a day, gradually from one side of the field to another. At Sofiendal Farm (see later) five men attend to the tethering of the 300 cows.

TUBERCULOSIS IN CATTLE.

Denmark has by her law of March 1898 aimed at the extinction of tuberculosis in cattle by forbidding what was deemed to be a fruitful source of infection, namely, the feeding of calves by raw skimmed milk. That law enacts that all milk used for the food of cattle must be pasteurised, *i.e.*, subjected, though it be but for a moment, to 85deg. C. (185deg. F.), such an exposure being apparently regarded as sufficient to kill the bacillus of tubercle. If by chance the pasteurising plant belonging to a vendor of skimmed milk be broken down, then the purchaser of the milk shall be informed, and the milk must be used for some purpose other than cattle food. This law does not cater (at least primarily) for the health of the human subject.

It is also not permitted to import from abroad milk or butter-milk which has not been heated to at least 85deg. C.

Numerous samples of milk are examined from time to time with the view to ascertain how far all milk intended for the food of cattle has been pasteurised in accordance with the statute above referred to.

The test is very simple in its application, two small bottles and a test tube being alone necessary.

The reagents employed are para-phenylene-diamine and hydrogen peroxide. If the milk in question has not been heated up to above 80deg. C., a blue colour results; if it has been thus heated, the milk retains its normal colour. This blue colour is apparently due to an enzyme which is killed at 80deg. C.

As has already been observed, the "separator-residue" which collects on the inside of the separators has by the Danish law, to be burned.

Of the two millions of cows in Denmark, only a small proportion have been tested for tuberculosis. Hr. Boysen, the Director of Slaughtering at Hamburg, estimated the number at 70,000. A farmer is under no legal obligation to have his cows tested, neither is he compelled to employ a veterinary surgeon for any purpose whatsoever. If, however, he elect to employ the test the State affords him certain facilities for so doing, the Government voting an annual sum of 100,000kr. (£5,500) for the purpose. All cows declared to have tuberculous udders must be killed in the public slaughter-house under the supervision of the police master, and the owner obtains compensation in the shape of one-fourth of the value of the cow, plus one-half the value of the diseased meat, together with such portion, if any, of the carcase as is certified to be fit for food. Compensation is granted only in respect of tuberculous cattle killed in the public slaughter houses. Cows having tuberculosis of the lungs need not be slaughtered by the State. If a private veterinary surgeon regard a cow as tuberculous he can settle any doubt he may have by taking or sending material therefrom to the State Veterinary Surgeon for examination. An owner suspecting a cow to be tuberculous is required to notify the fact to the State. He must not allow such an animal to be sent to market, or to be exhibited, or exported, and must not sell its carcase until the veterinary surgeon has declared it free from the disease. The milk of cows with tuberculous udders must not be sold.

RAILWAY TRANSPORT.

Nearly all the railways in Denmark are State-owned. We had an interview with the officials in the General Manager's Department, and with the Traffic Superintendent at Copenhagen, who afforded us the following information:—

The railway companies aim at the transport of milk and butter by passenger train, but they are not, it is alleged, aided much in their endeavours by farmers or milk companies. For example, all orders reaching the railway authorities for carriage of goods on white paper forms are by the regulations to be dealt with on goods trains, and milk dealers with rare exceptions make use only of these white forms. Nevertheless the milk is delivered as quickly as possible, and is, moreover, wherever practicable, sent by ordinary passenger train without extra charge; just as is the case with goods notified on pink paper forms, but which are charged an added 50 per cent. of freightage. There is also a brown paper order form for goods of a very perishable character and needing immediate delivery, which ensures carriage by express train at added cost. There are privately owned ice wagons, *e.g*, Mr. Busck's vans, and some 120 ice wagons in the country in all. Ice costs the railway authorities 6kr. (6s. 9d.) per 500 kilogrammes; and each ice-furnished wagon costs the user 12kr. (13s. 6d.) in addition to freightage; charges which apparently go far to prevent general use being made of such wagons. But all butter and bacon for England are carried in this class of truck, with its double walls and roofs, the inter-spaces being filled with dried rice husks.

The wagons in which milk is usually conveyed are painted white, and while they have neither double walls nor roofs, and do not contain ice, they are specially ventilated by four ventilators, with upward draught, near the roof, two on each side of the vehicle.

Trains are arranged to run at hours convenient for the milk trade: *e.g.*, a train leaves Masnedo at 5.40 a.m. and at 5.53 p.m., and passing through a dairying country, reaches Copenhagen at 9 a.m. and at 10 p.m.

Up to the time of our visit no milk had been exported from Sweden to Denmark, but two ferries are running from Copenhagen to Malmö, and each is capable of carrying 16 loaded railway wagons, and covering the 20 miles in but little over an hour.

The ice wagons are the invention of Professor Schou, who has, he told us, also invented an improved method of truck ventilation, whereby, with the addition to freightage of 2kr. (2s. 3d.) per wagon on ice, the value of meat transported to Berlin during the hot weather has been increased 380kr. (£21 7s. 6d.) per wagon over that sent in ordinary fashion.

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* Copper in peas is absolutely prohibited. The Danes eat tinned peas "off colour."

Ocean Transport of Butter.

The export trade in butter from Denmark is an enormous one, and Mr. Harald Faber has marked for us a map of the country showing the chief ports for purposes of shipping butter to be Copenhagen and Nakskor in Zeeland, Svendborg in Funen, and Esbjerg, Frederikskave, Aalborg, Randers, and Aarhus in Jutland.

From Copenhagen all the boats leave on one and the same day each week, viz.: Thursday, for England *viâ* Hull and Newcastle-on-Tyne, and for Scotland viâ Leith. The reason for this simultaneous sailing we could not learn. Captain Parker of the S.S. "Rona," of Leith, kindly showed us over his vessel, the first to be fitted with a refrigerating apparatus, at a cost of £1,500. The chief engineer explained to us the machinery and its method of working. There are five holds, each of which can be kept at a temperature of 45° F. if necessary, but as a matter of fact, some 2,000 to 4,000 casks only form the weekly butter cargo of the "Rona." Each of these holds is piped under its deck covering, the cooling agent being brine of low freezing point, which is constantly circulating from the engine through the pipes and back to the engine again and again, to be cooled down before being sent on its way each time. The bulk-head and the double sides of the holds are lined with non-conducting material. Formerly the worst feature of the cooling apparatus was the dripping from the pipes of melted ice-water on to the butter casks in the holds, but this is now almost entirely obviated by bringing the machinery into action before the butter comes on board and by keeping it going until the butter has been removed again. Of course all such drippings were merely due to the condensation of moisture upon the cold iron pipes. Cloths are always spread on the casks to prevent any drippings that may still fall, from damaging the butter.

In company with Mr. Brienholt, the German Consul at Esbjerg, and one of the directors of the Danish Steamship Company, we visited the S.S. "N. J. Fjord," at Esbjerg, she being one of the company's vessels which is fitted with carbonic acid refrigerating plant for the purposes of the export butter trade, the arrangements being such as to enable any one of the holds to be cooled independently of the others. The refrigerating apparatus is started some hours before the vessel's departure in order that the temperature of the holds may be properly reduced in time to receive the cargo. Any of the vessels of this company can load from a covered quay, which protects the cargo from sun and rain, and it is intended to extend the roofing-in of the quay so as to permit of the cargo of three boats being loaded at the same time under cover. There are some two miles of piping on board the boat, wherein the brine (a solution of calcium chloride) is kept at not less than 4 deg. below freezing point, it losing about 3 deg. in its passage through the pipes back to the engine, which it leaves again at 7 deg. below zero. The double walls are lined with felt. The loss of space caused by the apparatus and linings is 5ins. all over the ship, and the extra weight is considerable.

A DANISH FARM.

Sofiendal, Haslev.

Among the introductions given to us by Mr. Harald Faber was one to Hr. Ulrik, of Sophiendal, a large farm near the small town of Haslev, some 30 miles south-west from Copenhagen; and from this gentleman we received a cordial invitation to spend a day at the farm and see its various operations in relation with milk and butter. We were glad to be able to avail ourselves of the opportunity thus afforded us, and we accordingly devoted a whole day to the purpose, from the afternoon of one day to the evening of the next, returning by the train which brought with it much milk to Copenhagen from the southern parts of Zeeland.

Sophiendal is a large farm of some 300 cows, and with a milk business of 50,000 to 60,000 kr. yearly, entailing an annual outlay on about 400,000lbs. of maize for cattle. It is managed by Hr. Ulrik for Count Moltke, who owns much property hereabout.

Milking is performed at 4 a.m. and 4 p.m. The tails of the cows are cut in winter for purposes of cleanliness, and the coats of the cows brushed twice a day. Although it is not considered desirable to wash the cows' udders, each of the milkers has her own clean cloth wherewith to rub the udders in winter; and is provided once weekly with a clean blue apron to wear over her dress. Each milker washes her hands before beginning to milk, and rinses them between the milking of each cow. She milks from 18 to 20 cows, the milk being at once removed from the stable, emptied into a large can, and screened.

Appendix.

At our visit we saw the cows being milked in the fields. There was no cleaning of the udders then (it is not regarded as requisite in the open in summer), but the women frequently rinsed their hands, and the milk of each cow was at once passed through a fine metal gauze screen, which was covered with a white cloth, into a churn standing in a cart. The milk was also strained at the farm before passing over an 18-coil cooler, and it was then placed in an ice-water tank till despatched. The milk is weighed before being sent off, and the cans are sealed.

Very little morning milk goes to Copenhagen as whole milk, but as cream and half-skimmed milk.

The milk is sent by rail in ice wagons belonging to the railway company.

In future, the milk from Sophiendal was to be sent for butter and cheesemaking to "Trifolium" (see latter), instead of into Copenhagen.

We took the dimensions of one of the cow houses at Sophiendal. It serves for 112 cows, the heads of the cattle in each double row being 4ft. apart. The house is 45ft. wide, and each of its eight sections is 15ft. long and 12ft. high sufficing for 14 cows, and giving each of them 580 cubic feet of air space. There are seven doors in the stable, and 15 windows, all opening in part. The stable is quite in the open. Floor, ceiling, and walls are whitewashed twice yearly. Every two cows have one water trough, which automatically fills, but never overflows. This is regarded as a safeguard against tuberculosis, such as would not be procured by a water supply common to the whole herd. The water is from a pump well in the yard. The house is maintained as far as practicable at 13°C. (55° F.). The excretions, which are removed twice daily, fall into square-cut stone trenches in the rear of each row of cattle, which trenches form effective channels for the disposal of liquid filth. The cows are in the stables from October 1st to April 30th, never being out of doors during that time. 30lbs. weight of roots is given to each cow daily. Milk can be sent from cows fed as the farmer chooses so long as the butter derives no unpleasant taste therefrom.

Kobenhavns Mælkeforsyning.

The Copenhagen Milk Supply Company, now for many years associated with the name of its originator, Mr. G. Busck, of that city, very kindly placed all their available information concerning methods of procedure at our disposal, and in the persons of the director (Forretningsforer J. G. Smith) and the analyst (Hr. G. v. Ellbreckt) we found capable exponents of the system adopted.

The business premises are situate at Frederiksberg, on the western side of the city, and they have in all entailed an outlay of about £15,000. There are employed some 170 adults and 160 boys, and 58 horses are in working. The company trade under a mark which consists of two heads of clover, one red and one white, on a black triangle, with a circular pink background. The water supply is from a well in the yard, taken from a depth of 51ft. from the surface. The water contains much iron, and is filtered before use.

The ice-house has double walls, with intervals of 2ft., the space being filled with sawdust, and beneath the floor there are arrangements for draining off the water resulting from the melted ice.

In August last, 35 farms were sending milk to the company. Every farmer's milk is tested, from 100 to 120 samples being chemically analysed, and some 40 samples physically examined, each day. Cows furnishing the milk must be kept in the fields till mid-September. The application of the tuberculin test is not now compulsory.

Much of the milk comes by rail in special ice-wagons belonging to the company. Ice is introduced by openings in the roof into ice receptacles situate at either end of the wagon, the receptacles being provided with waste pipes for the escape of melted

Appendix.

ice. The ice is put in at the city premises, in order that the wagons may be sent back with the empty churns in a cool temperature. We found the air of one wagon to have a temperature of 14° C. (57° F.) on a hot August night, the wagons having finished a day's travelling to the farm stations. The temperature was 17° C. (63° F.) at 7 o'clock a.m. after the doors had been open all night. Each wagon takes 1,000lbs. of ice, and holds 105 milk cans each containing 50 litres. The ice comes from Danish lakes, and costs 2s. per 1,000lbs., including labour of housing it in the huge store chambers.[*] The charging of a waggon costs about 2s. 6d. About five millions of lbs. of ice were used in 1889 on the premises.

Milk comes a distance of from 10 to 50 miles, the longest distance occupying three hours in actual transit. It leaves the country stations from 7 to 7.30 p.m., and reaches the premises in Copenhagen from 10 p.m. till midnight. Jyderup, Soro, Dregentved, Haslev, &c., furnish milk, and from the 1st September last milk was to come from Nykjobing in Sweden, 7 hours' distance. The ice-wagons are attached to passenger trains. The milk is dispatched from farms so as to reach stations only half an hour before the departure of trains.

Milk is sent out for delivery in the city only once daily, so that although customers get their day's supply in two rounds, it is the same milk, the carts doing the circuit twice for the convenience of householders. No complaints have been received from customers. On Sundays, only one delivery is made. Forty carts start about 5 to 6 o'clock in the morning, each cart having its specified "round." At the houses of the customers the milk is emptied from the churns into small "cans," and from these into the domestic receptacles provided by the householders. The taps of the churns on the carts are covered by metal flaps to prevent the ingress of dust and dirt to the nozzles, and special milk in bottles is placed in ice in a separate covered part of the van. Superfluous milk left over after the days' distribution (some 5 per cent. as a rule) is put through a separator, and the resulting cream made into butter.

The farms furnishing milk have an average of 150 cows each. The conditions which regulate the feeding of milch cows, their milking, the delivery of milk, &c., are very strict, and have been in existence for many years. A translation by **Mr. A. Stewart Macgregor**, late British Vice-Consul at Copenhagen, runs as follows[†]:—

Regulations for Contractors.

A.—Feeding and Management.

I.—The food of the cows must be of such a nature and quality that no bad taste or taint may be imparted to the milk by it.

- *a.* Brewers' grain and all similar refuse from distilleries are strictly forbidden, as also is every kind of fodder which is not fresh and in good condition.
- *b.* Turnips, kohlrabies, and rutabaga are absolutely forbidden. No kind of turnip leaves may be used.
- *c.* Carrots and sugar beets (mangolds) are permitted up to half a bushel per cow, but only when at least 7lbs. corn, bran, and cake are given along with them. Cows supplying infant milk may get carrots, but never more than a quarter of a bushel per head.
- *d.* Oilcake. Rape seed cake is the only oilcake which may be used. $1\frac{1}{2}$lbs. is the furthest limit, along with at least 5lbs. corn and bran. Infant milk cows must not receive any cake.
- *e.* The proportions in which the different kinds of food are to be given must be arranged with the company before the contractor commences to supply milk.

II.—Stall feeding in summer will not be permitted under any circumstances. The cows must be fed in the open air upon clover and grass. Vetches are forbidden. In a case of necessity dry food or cut corn may be given, but on the field.

III.—In autumn the cows must be clipped on the udder, tail, and hind quarters, before being taken in.

IV.—Calving should be so regulated that the milk sent in during the months of September and October is not less than two-thirds of the largest quantity sent in any other month.

V.—The milk of cows newly calved must be withheld for twelve days after calving, and must not be less in quantity than three imperial quarts per day.

B.—Milking.

VI.—The greatest cleanliness must be observed during milking, and the milk must be strained through a wire sieve covered with a clean woollen cloth.

VII.—Immediately after milking, and during all seasons of the year, the milk must be cooled down with ice water to 40° Fahrenheit.

VIII.—Every contractor must be provided with a Lawrence cooler, which he can obtain on hire from the company.

IX.—Thirty pounds of ice, making due allowance for waste, must be kept in stock for every 100lbs. milk produced, which can be calculated from the fortnightly trial milkings.

C.—Delivery of Milk.

X.—*a.* The milk must be delivered at the nearest station once or twice daily, according to the requirements of the company, either as whole milk, or as "half-skimmed" milk and cream.

b. The milk must not be sent from the farm earlier than is absolutely necessary for its arrival in proper time at the railway station.

c. In summer the van for conveying the milk to the station must be provided with a cover to protect the milk from the heat of the sun.

XI. The company will supply the cans necessary for transport.

XII.—The company cleanse the cans before returning them, but they must be carefully rinsed out with cold water as soon as they reach the farm again, to get rid of any dust or dirt which may have adhered to them during the return journey.

The cans must be placed in a cool airy spot, until again required, protected from all impurities, with lids off, and bottom upwards, but in such a position that the air can freely get into them.

XIII.—The cans may not be used for any purpose but the conveyance of milk.

D.—Further Regulations.

XIV.—The contractor is bound, upon word of honour, to answer any inquiries made by the company concerning the milk supply.

XV.—The contractor must allow any of the veterinary surgeons of the company to inspect his cattle as often as the company requires, and must drive the surgeon to and from the station. The contractor is bound to follow out closely the instructions of the veterinary surgeon.

XVI.—Any cow declared by the veterinary officer to be suffering from tuberculosis must be instantly and entirely separated from the rest of the herd, and should be got rid of as soon as possible.

XVII.—The contractor must promise immediately to inform the company of any case of illness which may arise between two visits of the veterinary officer. If necessary, he must withhold his milk until the veterinary officer arrives and inquires into the circumstances.

In such a case the full price will be paid for the milk.

XVIII.—The contractor, to the best of his ability, must watch over the health of all who reside on his farm, or work upon it, also the families of the latter.

Should a case of infectious disease arise among any of them, he must immediately report the fact to the company, and withhold his milk, which will nevertheless be paid for as usual, if these conditions are fully complied with.

Ice cost 16 kr. (17*s.* 10*d.*) per ton when imported from Sweden.

[†] Milk Supply of Copenhagen, by A. Stewart Macgregor 1890.

XIX.—Either of the contracting parties, after having given six months' notice, can terminate the contract on the following 1st of January.

XX.—Should the company find the milk of inferior quality, and therefore unfit for sale, they shall be entitled to refuse to take it, without giving any compensation to the contractor.

XXI.—If owing to an epidemic, or other unavoidable cause, the sale of milk in Copenhagen should be suspended, the contractor must withhold his milk for a shorter or longer period without compensation.

Contractor's Pledge.

I agree to the above.

……………………………………………………

Signature of the Contractor.

The following forms, Nos. 1 to 4, are regularly employed by the company:—

I.—FORM FILLED UP BY THE VETERINARY SURGEON EVERY FORTNIGHT.

Name of Farm ——— Number of Cows ——— Stock of Young Cattle ———

Month.	Day.	Stock of Cattle.		Put in to Supply Children's Milk.	Withdrawn from Supplying Children's Milk.					Withdrawal from Supplying Sweet Milk.				Cows Temporarily Withdrawn.		How much Milk did the Cows Temporarily Withdrawn give at the last Trial Milking, and what became of the Milk?	General Condition of the Cows.	Are the Cow-houses kept Perfectly Clean.	Are the Udders in particular kept Perfectly Clean.
		Cows giving Children's Milk.	Cows giving Sweet Milk.		As Milked Dry.	For Tuberculosis of the Udder.	For Tuberculosis in Other Organs.	For Other Diseases.	As Suspected of Tuberculosis.	For Tuberculosis of the Udder.	For Tuberculosis in Other Organs.	For Other Diseases	As Suspected of Tuberculosis.	Cows giving Children's Milk.	Cows giving Sweet Milk.				

(Signed) ———

Veterinary Surgeon.

II.—FORM FILLED UP BY THE COMPANY'S INSPECTOR.

Name of Farm ——— Contractor's Name ———

Month.	Day.	Is the Cooling Apparatus in order?	How much Ice is in stock?	How is the Ice kept?	Condition and Size of the Milk Coolers employed.	General Remarks upon the Dairy.	Number of Cows in stock.	Condition of Cows.	Quality of the Hay and Straw used.	Are the Company's Instructions followed with regard to Feeding?	Is sufficient Cleanliness observed during Milking?	General Remarks on the Condition of the Cows and Cow-houses.

(Signed) ———

Inspector.

III.—FORM FILLED UP BY INSPECTING DAIRYMAID

Month.	Day.	Impressions as to the Cleanliness Exercised During Milking.	Faults requiring Speedy Correction.	Manner of Employing Ice in Cooling.	General Remarks

(Signed) ———

Inspecting Dairymaid.

Appendix.

4. CIRCULAR.—INFECTIOUS DISEASES, COPENHAGEN MILK SUPPLY COMPANY, SOLBJERG, FREDERIKSBERG.

As the contractors are aware, it has now been clearly demonstrated by science that various infectious diseases may be transmitted through milk. It is therefore of the first importance to the company that no milk should be supplied to them from farms where there is any infectious disease in the families of the persons employed in milking. The company therefore earnestly request every contractor to report immediately any case of this kind.

The highest price in the market will be paid for the milk from such farms, as usual, if the notice is given in time to prevent it from being sold.

Requesting your signature to the enclosed, we remain, etc., (Signed)

The Committee of Management.

Milk is placed in ice-water almost immediately after arrival on the premises. It is taken from the wagons as soon as they draw up at the special siding for unloading, the cans being raised to the level of the floor by a miniature lift. We saw the milk arriving on August 24th, another hot night, and found the air of one wagon registered 16° C. (61° F.). One milk can in the van was decidedly warmer than the others, the explanation was probably late milking and consequent omission to cool the milk at the farm. The temperatures of differing milks taken haphazard that night were 13°, 13°, 16°, 16° C., and one was 17° C. It would be about 6° C. when it left the farm, and all milk was again cooled down to that degree (43° F.). Women test the sweetness of the contents of each milk-churn, and throw aside the sample tasted; and it is stated that not even so rarely as once a month has milk to be rejected. Each churn's milk is also tested as to temperature, and a register kept. Each can bears a seal showing its source of origin. The milk remains standing in ice-water till morning, save that for children, which stands only half-an-hour for purposes of cooling.

Besides the cooling on reception by the company, milk has also to be cooled at the farms, the morning milk being kept in ice-water, and sent up with the evening milk, but in separate cans. The evening milk is sent whole, but, as a rule, only the cream of the morning milk.

Milk is screened at the farms as soon as practicable after being drawn. It is screened in the fields in summer, the milk of every two or three cows being put through a fine wire gauze covered with a cloth. Cows are milked in the sheds in winter, the milk being drawn away at once and screened.

The milk is efficiently filtered at the company's premises through four layers of gravel of varying sized pebbles and three layers of cloth. There is also a smaller filter with two layers of gravel and two of cloth to be used only for any small amount of milk urgently needed. The gravel is washed with hydrochloric acid, also with soda and water, and sterilised at 120°C. (248°F.) after each time of using. It is then dried in a high pressure steam oven. The process of filtration is upward, first through the lowest layer of coarse gravel, then through the intervening finer layers to the cloths of close texture. Before being filtered the milk that has been standing to cool is intimately mixed with a perforated crescent-shaped metal disc, and stirred to obviate any unequal distribution of cream.

The milk can be kept sweet in the hottest weather. No trouble has been felt in the 23 years during which the company have been working. Milk drawn one morning will not in ordinary course be all of it used till the evening of the next day; and this after having left the establishment about 6 o'clock on the morning of the day succeeding its being drawn, for delivery on two rounds to customers.

Milk for children comes from special farms, and is watered down for infants with water which has passed through a Pasteur-Chamberland filter, which is cleansed weekly. We tasted milk in the early morning which had been bottled over-night, which had a temperature of 10°C., and for which the current price was 20 ore (2½d.) per litre. All such milk is bottled, in ¼, ½, and 1 litre bottles. The filled bottles are kept in ice, both on the company's premises and in the covered carts.

The company purchase a good deal of cream from farmers who do not send milk, all such farmers being under contract. Milk for creaming must stand ten hours at the farm. There are three classes of cream sold, namely—

1st cream, with	20 per cent. of fat, and costing 80 ore (10½d.) per litre.
2nd „ „	15 per cent. of fat, and costing 60 ore (8d.) per litre.
Extra „ „	26 (ordinary) and 28 (summer) per cent. of fat, and costing 1 kr. (1s. 1½d.) per litre.

Cream is sent long distances encased in wooden boxes with ice packed round the bottles, and an outlet for waste water. It is sent thus in 1-litre bottles, and also in cans holding from 3 to 10 litres each.

A large amount of the cream is sent to hospitals, and no complaints are made as to its condition. Indeed 2,000 Danish lbs. are annually sold without complaint. Cream in Copenhagen is vended only by dairymen and bakers; not by grocers. Some which had been whipped on the Saturday night preceding our visit was fairly "fresh" to the sense of taste on the following Monday morning. It should, however, be added, that the cream in question had been out during the whole of the hot Saturday "rounds" in the town.

Ordinary whole milk as received by the company furnishes 10-15 per cent. of cream, and has 5 per cent. of fat in summer, and an average at all times of 3·5 per cent.

About 300 Danish lbs. of butter (some 328 English lbs.) are made daily by the company. Such butter, as already stated, is made from milk returned from the town rounds, the cream used having been skimmed from the milk in question. All butter made by the company is sold in Copenhagen. A fresh starter is prepared for the butter every day. The cream, which has been previously cooled to 10° C. (50° F.), is some 34 hours old when placed in the churn. The act of churning usually occupies about half-an-hour. Danish salt to the amount of 3 per cent. is added by hand on the butter-working table, after the butter-milk has been expressed. This quantity of salt suits the local taste. No pasteurising is attempted, and no advantage is held to accrue from the use of pure cultures. It is thought that about 12-14 per cent. of water remains in the finished butter. The price of butter at the time of our visit was 1 kr. 20 ore per Danish lb., about 1s. 4d. for 17½ ozs. English.

Butter-milk is sold in the town, and is used by all classes. Some hundreds of pounds are sent once a week to England for use in the manufacture of biscuits, a quantity being several days old when despatched.

Great attention is paid to the cleansing of milk and butter receptacles by the company. The workers throughout the establishment are all in white, and are supplied with clean covering aprons twice weekly. The cans are cleaned by brushing with hot water and soda, and later washing out with hot water and lime, a ladleful of soda, about ½lb., being used for each pail of water, and 20lbs. of lime to 900 litres of water. The outside is then washed and steam injected into the cans, which are left to drain alike by the company's servants and by the farmers. The latter have not their own cans. The apparatus in which the cans are washed is itself subjected to like cleansing. Bottles are first washed in soda and water, then placed over revolving brushes, and then steam-sprayed. The corks, which are used only once, are of special make, and are tied by hand and sealed. The butter pots and lids are washed in soda and water, and the pots only in lime and water also.

Det Danske Mælke-Compagni.

System Casse.

We had the pleasure of being taken over the premises of this company by Director Fr. Salicath, this establishment also being situated at Frederiksberg. It has been working for three years, and is a wholesale business house only. It trades under the mark of a polar bear on an ice floe, with sun rising over the hill behind a strip of open sea.

The premises, which are paved with close-fitting stones in all parts, presented at the time of our visit a very cleanly appearance. The water is softened prior to use, and is obtained from a well sunk 170ft. into the chalk.

The business is a large one, some 35,000 litres of milk and cream coming daily from farms having from two to as many as 300 cows each. Milk is tested every day, samples being sent to the laboratory. The greatest distance from which milk and cream comes is 150 kilometres. The milk, which arrives in cans holding 50 kilogrammes each, is weighed on arrival, then placed in tubs, and pumped into a reservoir.

Milk in excess of the immediate demands is frozen and stored; it is used in a manner subsequently to be referred to.

Farms furnishing milk and cream are under the usual regulations, and subject to the visits of the inspectors and the veterinary surgeons connected with the establishment; these latter make monthly visits. Cows are tested and examined, and tuberculous cows are at once got rid of. The milk of newly-calved cows must not be supplied, and that from farms in which infectious disease exists is paid for but not used. Milkers must clean the cows' udders before milking, and must wash their hands immediately prior to the process. The farms must have ice for purposes of cooling milk.

Milk must not reach the establishment at a temperature above 10° C. (50° F.). The usual temperature on arrival is 15° C. (59° F.) in hot weather, but milk is often refused on account of its excessive temperature. Morning milk is sent in with the evening milk, but in separate cans. The special wagons which are used on the railways by this firm carry no ice, but are provided with double walls, and straw is laid on the top of and between the milk cans. The cans containing the milk to be cooled on the premises are placed in cooling tanks filled with ice, netting being spread over the cooling tanks to prevent birds from approching too near to the milk, which is kept in the ice for some 2-3 hours from about midnight. Milk is 4-5° C. (39-41° F.) when bottled; and a small piece of ice is placed over each bottle in hot weather to keep the milk sweet and cool until sent out in the morning.

Farmers strain but do not filter the milk, which is centrifugalised on the company's premises, and passed through a filter of large sized pebbles, by an upward flow, just prior to being bottled. The filtering material is thrown away after each time of using.

All whole-milk sent out in bottles is pasteurised, the preparation for pasteurisation being as follows: Huge vats, each capable of holding 500 litres, are partly filled with milk, and to each 300 litres of this milk there is added 200 litres of milk in a frozen state. The mixture of solid and liquid milk is then kept in the vats for an hour and a half, until the whole is fluid. The milk is then pasteurised by raising it to 85° C. (185° F.), keeping it at that heat for two or three minutes, and then passing it in the usual manner over cold water coils. Metal lines are laid in the company's premises for facilitating the removal of the large vats from place to place; and trollies for holding four of the 50 kilometre cans are able to be wheeled about by one man. There is standing room for 30,000 litres of frozen milk in the refrigerating shed, in case it should be necessary to store such a quantity at any one time.

All skimmed milk delivered from the dairy is pasteurised. It is sold in 50-litre cans.

Milk is bottled automatically by means of self-acting siphons. Papier-maché "corks," made on the premises, are used; they are boiled in paraffin, but there is no resulting smell, the corks being dried under extreme heat. Bottles to be cleansed are first fitted upon a revolving wheel, and by this means are carried through a bath of soda and water; they are subsequently washed out with revolving brushes, and finally sprayed with cold water.

Bottled milk will keep for one day in the hottest weather, and for two days in cool weather.

Some 2,000 litres of cream are sent out daily, in three classes:

1st, 30 per cent of fat, 1kr. (1s. 1½d.) per litre
2nd, 15½ ,, ,, 45ore (5¾d.) ,,
3rd, 14 ,, ,, 40ore (5d.) ,,

the latter going largely to bakers.

An experiment, that failed to pay, was made of sending pasteurised milk in bulk to England, Scotland, and Buda-Pesth. The milk was sent in a frozen condition in a large can or receptacle surrounded with thick felt. The English importers refused to pay 14 ore (1¾d.) per litre for milk, and would not pay 1kr. (1s. 1½d.) per litre for cream containing 42 per cent. of fat, while Copenhagen was paying that price for 32 per cent. of fat.

The company make butter only to the extent of some 30 to 40lbs. daily in summer, but 300 to 400lbs. each day in winter.

The Milk Supply Pasteur.

This firm, which has been in operation for five years, and which deals in the main with bottled milk, was devised and projected by Director Krohne, with the scientific co-operation of Professor Faber and Dr. Schierbeck of Copenhagen. The staff is a large one, 300 workers, including boys, being employed, and 80 horses being necessary. There is an ice-making plant on the premises. About 40,000 bottles of milk are pasteurised daily.

The farmers supplying the milk are under detailed control, and every month or three weeks the farms are visited by a veterinary surgeon attached to the establishment. There are fixed regulations as to the fodder of the cows, for the treatment of the milk, and for the notification of tuberculosis.

The institution itself is situated in the outskirts of Copenhagen and the railway waggons which convey the milk to Copenhagen are not provided with ice chambers. The milk on reaching the factory is received into a reservoir when it is duly weighed and strained, and from this it is pumped to a filter consisting of layers of gravel and felt, the whole apparatus being carefully sterilised daily.

After filtration the milk passes to the cooling apparatus, and from this to a second reservoir, from which it is pumped to the pasteurising apparatus (which is also sterilised daily after use) where it is raised to a temperature of 85°C., the whole process being so arranged as to exclude the admission of air-borne organisms. The milk is then cooled to about 3°C., the pasteurising and cooling occupying altogether about 5 minutes. From the cooler the milk is led to a reservoir, also guarded against the entry of extraneous organisms, and from there to the bottle-feeding apparatus, a machine fitted with tubes, by means of which the bottles can be conveniently filled.

The bottles, which are furnished with glass stoppers, are, after being filled, carefully sealed to prevent their being tampered with.

The employees who are brought in contact with the milk are all under medical supervision. In the event of their being ill they are refused admission to the factory, and the same exclusion obtains if infectious disease is present in their homes. They receive under such circumstances full pay during their absence.

The bottles which are used for small quantities of milk, as also the cans which are used for large institutions, are first thoroughly cleansed in hot water to which soda has been added—the interior of the bottles being washed out by means of revolving brushes—and after this they are completely sterilised in a large steam disinfector which is kept at a temperature of 105°C. for half an hour.

The several processes are under daily control, both chemically and bacteriologically. Specimens of pasteurised milk are tested daily by Professor Storch's reaction to ascertain whether or not pasteurisation has been properly accomplished. Bacteriological examinations are made daily, and the percentage of fat is also estimated.

The Advantages claimed by the System.

Dr. Schierbeck was good enough to set out for us the advantages claimed by the process, and they may be thus summarised:—

1. All danger from the possibility of infection of the milk, either at the farms or during transit is thereby discounted.

2. The distribution of the milk in sealed bottles is a safeguard against its infection or contamination in the milkshops or in the streets.

3. The milk awaiting consumption in the houses is kept free from contamination by means of flies, dust, or polluted air.

It is claimed that this is the only practicable bottle system for milk at moderate price, and that the pasteurisation of the milk places less onus on the farmers as to cooling, etc.

It is, moreover, urged that the conveniences which are afforded by bottled milk are likely, in at least some degree, to present a remedy or alternative for some of the spirit drinking proclivities of certain sections of the community.

It may be added that, as regards children, the Copenhagen Health Department advise sterilised milk in preference to pasteurised milk. The boiling of milk for infants is common in Copenhagen, many people using Sohlet's apparatus, which costs about 11s., for the purpose.

HASLEV CO-OPERATIVE DAIRY.

As being typical of an industry which is in operation to-day in different parts of rural Denmark, we visited, while at Sofiendal, the small dairy at Haslev town. It is a self-contained creamery on the co-operative system, and complete down to its telephone and its own electric plant. The water supply is from a well sunk 62 ft. into the chalk. No ice is used, cooling being effected by cold water only. The engine is of 6 horse-power, and the boiler of 14 horse-power.

The milk from 1,200 cows is dealt with daily. All the milk on receipt passes through a strainer fixed over the weighing machine, and also through a centrifugaliser, each centrifugaliser dealing with 3,600lbs. of milk per hour. Milk is then warmed to 40°C. 104°F.), the cream and the skimmed milk running by separate channels to different pasteurising plant, each being pasteurised at 90°C. (194°F.), the cream thereafter being cooled down to 10-12°C. (50-54°F.) by means of a cold water coil-cooler. The pasteurised skimmed milk is returned to the farmers, each of whom has his own cans. The cream is again heated to 40°C. (104°F.), and the butter started from Copenhagen Laboratory introduced. The cream stands till next morning, when it is churned for half an hour, the colouring matter, 5lbs. per cent. of butter, being added in the churn. Each churn makes 180-200lbs. of butter in half-an-hour. When the butter-milk has been expressed, on the worker, salt is added in the proportion of 7 per cent. for Northern England, and 2 per cent. for London. The salt is thought to lose three-sevenths of its weight in the working, at least 40 revolutions of the table being made. The butter is placed in cold water after being worked, and is again put on the table before being packed in casks, the retention of not more than 11 per cent. of water in the finished article being aimed at, and not more than 16 per cent. permitted.

Here, then, was a small co-operative dairy in full working, 30 miles from any large town, replete with all modern appliances, and self-contained in all essentials.

THE CO-OPERATIVE DAIRIES OF THE ISLAND OF FANÖ.

As instances of the ability of the Danes to work on the co-operative system in a small way, we may refer to the creameries situated on the Island of Fanö off the western coast of Denmark, near to the town of Esbjerg. At either end of this island is a small town or hamlet, and a complete co-operative creamery at each place draws its milk from the neighbouring portion of the island. The larger of these two creameries is that situated at Nordby, opposite Esbjerg, the smaller being at Sönderho, at the southern extremity of the island. Both creameries are practically identical, and a brief description of that at Nordby will suffice for our purpose.

The creamery draws its supplies from some 300 cows kept in that part of the island, each farmer possessing from three to five cows. The whole-milk is delivered on a platform outside the creamery. It is there weighed, warmed, centrifugalised, and pasteurised in the usual fashion, the resulting cream being cooled and prepared for churning, the separated milk, which has, of course, also been pasteurised, being returned to the farmers or otherwise disposed of.

The butter, which is lightly salted, is for the most part for purely local consumption. The milk churns are not cleaned at the creamery, but by the farmers themselves; the water supply to the farms is usually from shallow wells.

All the machinery, including furnace, boiler, heater, separator, and pasteuriser, is quite complete, both at Nordby and Sönderho. Ice, save quite in the hottest weather, is not found necessary.

"TRIFOLIUM," HASLEV.

A large co-operative society had quite recently been established at Haslev, under the name of "Trifolium." The buildings were nearly completed at the date of our visit, and we had the good fortune to be taken over by Hr. Ulrik, to whom the accomplishment of this great movement is primarily due. The buildings are spacious, well paved, ventilated, and lighted, and replete with modern fittings, plant, appliances, etc. The company will have their own electric plant. The water is obtained from a deep well in the quadrangle. There are two boilers, one of 25 and one of 50 H.P. Milk will be sent by 41 farmers, owning 6,000 cows, the milk churns on arrival being emptied automatically, and then passed by an automatic gear to the cleaning room, where all cleansing operations will be performed by steam. The whole-milk will be at once weighed, and centrifugalised in Laval centrifugalisers; the cream will then be pasteurised, cooled to 13°C. (55°F.), and placed in cisterns, where it will stand. A starter prepared with a culture from the Copenhagen Laboratory will then be added in the cream, which, when ready, will be churned. Each of the six churns will make 150lbs. of butter in half an hour, 900lbs. in the aggregate. The butter-milk will next be expressed, and the salt mixed in by machinery. Long tables, probably with marble tops, will be used for making up the butter into English pounds. A pump will raise the butter-milk to a pasteuriser, from which it will run to a cistern. Some will go to farmers, and some to the cheese-making section.

In addition to the butter made on the premises, the company will purchase supplies from small farmers and from 41 smaller co-operative societies. Each of the smaller societies will form a central creamery to which cowkeepers will send their milk, owners of from 1-30 cows thus disposing of their milk in butter making.

It is estimated that, in addition to the butter made from milk of 6,000 cows, sent direct every day to "Trifolium," there will be received daily cream from the produce of 3,000 cows by rail, and each week some 30,000lbs. of butter from the 41 subsidiary societies above referred to.

The butter received and made on the premises will stand for twelve hours in the cold chambers which are to be cooled by means of the usual ammonia apparatus, the cooled air entering at the top of the chamber, being allowed to descend by virtue of its superior weight on to the butter. The butter will then be packed in lb. rolls and put into casks. The cooling chambers which are provided with double walls and doors, the intervals of which are filled with dried rice husks, can be kept at 3°C. (37°F.).

Skimmed milk will pass to another section of the building and be subsequently used for cheese-making. There is storage room on the premises for some 300,000lbs. of cheese. The store-room walls are double, and lined with non-conducting material. The room can be warmed or cooled at will, and the amount of moisture contained in the air can also be regulated; by these means the results of climatic changes can be in large part obviated.

Ice will be made on the premises, and also the wooden casks and boxes for butter, etc.

ESBJERG CO-OPERATIVE BUTTER FACTORY.

The director of this important factory was good enough to allow us to inspect it, and to afford us the following information relative to its operations.

The factory is supplied mainly from the neighbourhood of Kolding, but also from other places in the northern portion of Jutland. The butter arrives by rail, either in white-painted or refrigerating vans, according to the exigencies of the situation.

Although this establishment is only five years old, it has the largest business of its kind in Denmark, and employs about 150 hands. It exports no less than ten million lbs. of butter every year (27,500lbs. daily), none of which is made on the premises. All butter reaches the factory in a half-worked condition from some sixty large creameries. These creameries send (1) fresh butter, saltless on arrival, and (2) butter containing some 3 per cent. of salt. Some of the saltless butter is sent, still saltless, to England, as also is some to which only one per cent. has been added, so that it will contain only about one-half per cent. on leaving the establishment. It is the only known factory in the country which packs absolutely fresh butter, and in connection with the keeping powers of this butter it may be here recorded that it has been despatched to the Paris market *viâ* Esbjerg, Harwich, London, Southampton, and Havre. Such butter, in spite of delay, etc., on the English railway, has reached Paris quite fresh and has fetched 4½ francs per kilo. But whether the butter be salted or fresh, it will keep upwards of three weeks, if only it be quite fresh and sound when it reaches the factory from the creamery. Otherwise it tends to "go off" more rapidly.

The butter on its arrival at the factory is classified, and the different supplies of each class are blended. Any not regarded as good enough for packing in rolls is salted, and sent away as second-class butter, but this very rarely happens, as a very low price is paid to creameries for such an article, and, in addition to the consequent endeavour of the suppliers to furnish butter of first-class quality, there is the fact that all dairies desirous of joining the society must have acquired a high character for produce on three successive occasions at local exhibitions. It goes almost without saying that all cream used for the butter has been pasteurised, the exigencies of the English market being said to render this process essential.

After its receipt and blending, the half-worked butter undergoes its first working at the factory, the salt being added at the time of its second working there. It is worked a third time for purposes of ensuring the expression of as much butter-milk as possible, and herein it is thought lies the excellence of its keeping quality. Butter for the London market is coloured with Danish colouring matter.

Each pound is separately weighed by women or girls, who frequently rinse their hands in hot water, and it is then wrapped in parchment and enclosed in a cartridge paper box. The butter is despatched to England in five boats weekly, three steaming to Parkeston Quay, Harwich, and two to Great Grimsby, some of the vessels carrying refrigerating plant. The butter is some of it only four days from the churn when the English retailer gets it on his counter, and is none of it more than five or six days old. If it have to travel far from the creamery to the factory, ice waggons are used; but if not, then white-painted and well-ventilated vans.

The manager informed us that when the butter reaches England its troubles as to keeping begin. If white-painted or iced vans were used on the English railways here concerned, the Danish butter merchants would much appreciate it.

There are cold chambers at the factory, which are kept at 2°C. (36°F.). They have double doors of a specially designed form to effectually exclude the warm outer air. The ammonia cooling apparatus is used for keeping the chambers cool, and the factory also generates its own electric lighting. No ice is employed or deemed necessary, though the creameries use ice if they have no cold chamber.

Butter tubs, which are of oak, are made on the premises, as also are the boxes, which are constructed of pine wood from Norway. The tubs are cleansed by immersion in large cisterns filled with chalk and boiling water, chalk being regarded as a good cleanser.

The water supply of Esbjerg is from a deep well two miles out of the town.

CONCLUSION.

Although, as we have already stated, we propose to allow this report to tell its own story, a few comments may perhaps be made with the view of focussing the information collected. As regards Amsterdam and Hamburg it is apparent that in respect of the former the use of pasteurised or sterilised milk is rapidly increasing, and in respect of the latter that the addition of preservatives to milk is, as the result of a recent Act, becoming rare. There would seem, so far as we were able to ascertain, no serious obstacle in the way of supplying either Amsterdam or Hamburg with milk free from preservatives.

Our attention, however, has been mainly directed to Denmark, and it is to the practice there current that the remainder of our remarks will have reference.

It is clear that the Danes have appreciated in theory and have recognised largely in practice the vast importance of cleanliness, straining and cooling in dairy operations. These *principles* have permeated to the rural districts of the country, and by even a partial observance of them the Danes have been able to comply with the provisions of the law which prohibits the use in milk, cream, and butter of "preservatives" other than salt. Moreover, they have in certain instances dispensed with even small quantities of this latter article, and exported absolutely saltless butter to this country.

The Danes as a nation have recognised in a manner, and to an extent which is at present foreign to this country, that the destruction, inhibition, or regulation of bacterial activity is the basis of all successful dairying operations. They have appreciated in a practical fashion the fact that, in so far as milk is concerned, bacteria, some of which are associated directly or indirectly with the decomposition of such milk, may gain access to it from the time at which it leaves the udder of the cow to the time at which it reaches the consumer's mouth. Consequently they have set themselves the task of prohibiting as far as practicable the access to milk of all harmful bacteria, and of inhibiting the growth of such as may have gained access thereto.

This they have endeavoured to bring about by, among other precautions, encouraging the cleansing of the cow's udder prior to milking, by instructing the milkers to cleanse their hands, and by providing them with clean overalls.

Moreover, the Danes are alive to the importance of well-ventilated and well-lighted cowsheds furnished with floors and walls of an impermeable nature, and to the expediency of the frequent removal of manure from such cowsheds, although these principles have, as yet, only received partial recognition in actual practice. As we have already observed on page 283, we were not in our inspections so much impressed with the general superiority of the Danish cowsheds, as with the ability of the Danes to take full advantage of the somewhat meagre accommodation which is at times at their disposal. The Danes have a better grasp of the *principles* governing the keeping powers of milk than have the people of this country.

In the treatment of the milk after milking they attach due regard to its immediate removal from the relatively close and likely-to-be-contaminated air of the cowsheds, and to the necessity for this removal to be followed by careful straining and the best available means of cooling.

The Danes recognise the value of immediate exclusion, by fine straining, of such hairs and other materials as are likely to be coated with bacteria, and of the advantages to be gained by inhibiting the growth of bacteria by cooling. References may be made to the careful filtering through gravel and felt which takes place at certain institutions, and of the cleansing properties of the separating process.

In so far as the dairy utensils are concerned the absolute necessity of most scrupulous cleanliness, or of actual sterilisation by steam, is laid particular stress upon, and in respect of transport the use of refrigerating vans and of steamships fitted with refrigerating apparatus is daily increasing. Precautions are also taken to reduce to a minimum the duration of exposure of milk churns at railway stations by retaining the churns under cool conditions until their despatch to the train is called for. In places where the pasteurisation of milk is in vogue the immediate cooling of such milk after pasteurisation is regarded as an essential part of such process, the subsequent cooling being held to take from the milk any "cooked" flavour which it might otherwise retain.

It will have already been gathered that, as a matter of fact, the population of Copenhagen (some 400,000) are supplied with milk and cream without the aid of preservatives.

With regard to Danish butter it may perhaps be useful to relate that of the foreign butter annually imported into this country more than half is of Danish origin, and that such butter contains no preservatives other than a small quantity of common salt. Even this is in some cases omitted.

The departure taken by the Danes in the manufacture of butter has afforded an object for the study, and in some cases for the emulation, of other European nations.

Year by year the manufacture of butter from pasteurised cream prepared for the churn by the use of pure cultures has been practised in an ever increasing degree.

In connection with the subject of pasteurisation it is, we think, of importance to point out that cleanliness is regarded as a very necessary precedent to the process. If once the bacterial products have conferred upon the milk or cream any unsatisfactory flavour we are assured by Danish experts that no process of pasteurisation can remove such flavour.

By such pasteurisation the Danes have aimed at destroying what may be termed the *unknown* in the bacterial flora of cream, in order that by the use of "pure cultures" of bacteria they may be able to substitute the *known*. Their position is that without such precautions the production of a butter having a characteristic aroma is more or less a matter of chance, and hence cannot be absolutely relied upon. The essence of the usual method of butter making is to endeavour to bring about conditions which are favourable to the development of certain species of bacteria; the essence of the Danish method is to kill or inhibit the growth of all the bacteria concerned in the process of "ripening" and to promote the necessary souring of such cream by the introduction of a starter prepared from "pure cultures." By this means butter is manufactured which can be safely exported to England without the use of preservatives. It is of interest in relation to the bacterial flora of cream to note that there would appear to be a tendency to pasteurise at an increasingly high temperature, and experience indicates that, within certain limits, the higher the temperature at which the cream is pasteurised the better is the resulting butter likely to be. The progress of the practice of pasteurisation in Denmark has indeed been remarkable, and at the present time the vast bulk of Danish butter is made from cream thus treated. The passing of the law of March 26th, 1898, which renders the pasteurisation of milk used for the food of cattle compulsory, has doubtless been a force in the diffusion of the custom of cream pasteurisation, but the practice seems to have become general mainly owing to the satisfactory results which in the opinion and experience of the Danes have accrued therefrom. Moreover, the fact that the process is calculated to destroy most, if not all, the pathogenic bacteria has not been without its influence in a country where the care of the public health is made a matter of considerable concern.

It is, too, in our view, obvious, whatever opinions may be held as to the merits or demerits of the co-operative system, which has seen such a remarkable development within recent years in Denmark, that such system is very largely responsible for the numerous safeguards against the contamination of the milk, cream, and butter to which reference has now been made.

H. Timbrell Bulstrode.
Chas. J. Huddart

APPENDIX No. IV.

REPORT ON A VISIT TO IRELAND IN RELATION TO THE USE OF CERTAIN PRESERVATIVES IN DAIRYING AND HOG PRODUCTS.

With the object of supplementing the information obtained during the visit paid by two of our number to Amsterdam, Hamburg, and Denmark, with special reference to the use, or otherwise, of certain preservatives in the dairying industry of these places (see Appendix No. III.), we in mid-September last proceeded to Ireland. We had here in view the investigation of the actual conditions under which butter is manufactured, our object being to ascertain from personal observation how far the use of preservatives is imperative in Irish butter, or how far, as certain witnesses had stated, the use of these substances could be dispensed with.

In addition we were enabled to learn something of the conditions under which Dublin receives its milk supply, and of the methods of using preservatives in the bacon and ham curing industry.

The following account of our visit consists essentially in a transcription of the shorthand notes which were taken down at the time of our inquiries, observations, and cross-examinations. We have elected to take this course rather than to compose an essay upon all the aspects of Irish dairying, in the writing of which the facts which are alone essential to our inquiry might perhaps have lost their proper values. Here and there we have drawn such inferences as seemed to us deducible, and, moreover, we have at times introduced matter which although not strictly within the terms of our reference, cannot fail, we think, to be regarded as pertinent to the subject under consideration. It may, too, be added that our inquiries in Ireland were concerned for the most part with the second portion of the reference to the Committee, *i.e.*, to ascertain "to what extent and in what amount preservatives are used."

In all, we were three weeks in Ireland, of which time not a little was necessarily spent in travelling, and although we saw as much as possible of the great butter producing regions in the south and west of the country, we were only able to prosecute our enquiry to a very limited extent in the northern parts of the island. This we regretted, as we should have been glad to have ascertained for purposes of comparison with the south the practices now common in the north. In and around Dublin we spent three or four days, deriving much cordial assistance from the Government departments, and from the Corporation in the persons of Sir Thos. Pile, Bart., then Lord Mayor, and Sir Charles Cameron, the Principal Health Officer.

We had several conferences with Sir Charles Cameron, and for much of our knowledge as to the actual conditions affecting the milk and butter supplies of Dublin we are indebted to him and his medical colleagues, as also to Mr. Watson, the Chief Veterinary Inspector of the Corporation.

It may be at once stated that there is no legislation peculiar to Ireland on this subject, and that the only laws touching the question of deleterious additions to food in Ireland are the Sale of Food and Drugs Acts common to the British Isles.

The Dairying Industry in and around Dublin.

As regards Dublin, Sir Charles Cameron informs us that the city draws its milk chiefly from some 250 dairies within the city boundary, the source of the milk being almost entirely local. In his opinion the use of small quantities of preservatives in milk is preferable to the consumption of bad milk. Although no systematic examination of milk has so far been made with regard to the presence of preservatives, in Sir Charles's opinion the practice of preserving milk or butter is, in Dublin, relatively rare. By Sir Charles's kindness we were enabled to secure the views upon the subject of our inquiry of seven of the Metropolitan Health Officers. These gentlemen were good enough to meet us at the office of the Town Council. The following is a copy of the resolution which they handed to us on September 13th, 1900.

> "That in the opinion of the Dublin Metropolitan Medical Officers of Health, the use of drugs in food preservation is most reprehensible, and should be discontinued; although very minute quantities might be used without detriment, yet the unskilled doctoring of food by active drugs is dangerous.
>
> "(Signed) John Garland.
> " Michael Strahan.
> "Henry W. Oulton.
> " J. P. Quinn.
> " J. D. Crinion.
> " G. A. Stritch.
> " Henry G. Day."

In the course of conversation with these officers we learned that consumers in Dublin do not habitually add chemical preservatives to their milk, but one farmer at least is known to be sending preservatised milk to Dublin.

The very poor often get their milk but once a day, and they frequently possess inferior, if not very bad, accommodation for its storage in their houses. But the majority of the poor are not accustomed to store such milk as they purchase for any length of time, and one or two of the officers told us that it is a common practice for the poor to buy their milk in extremely small quantities as often as needed.

Sir Charles Cameron regards the relatively high infantile mortality of Dublin as being largely due to the use of milk in a state of partial decomposition. He entirely agreed with the view of his colleagues in the Dublin Health Service as to the insanitary methods of milk storage in the homes of the poor, where also the cleansing of milk vessels receives too scant attention. Still, that there is no necessity for the use of preservatives in the city milk service, was the testimony of the health officers as the result of an intimate knowledge of the actual conditions of the trade in the city.

Suckling is general in Dublin. Hand or bottle feeding is very rare. The opinion was expressed that for every twenty children bottle-fed in England there is only one child so fed in Dublin.

At one dairy in the city which we visited, we found the shopkeeper with the preservative known as "Arcticanus" in his back premises, the full directions for its trade use being given in a book issued by the Agricultural Chemical Society, Southampton.

Mr. Anderson, Secretary of the Irish Agricultural Organisation Society, with whom we had a long conference, and to whom we shall have occasion further to refer, expressed his opinion that chemical preservatives are quite unnecessary in milk. On the general question of preservatives, he said that the matter was for him one of trade principles only, and not one of public health. His objection, for example, would be met if the labelling of preservatised food and drink were made compulsory. He informed us that farmers sending milk to creameries for purposes of butter making do not use preservatives, but that those sending milk to a given town or institution as a rule use them largely. This he knows to be done in Dublin from the results of actual analyses. He thinks that preservatives militate against cleanliness in dairy farming. The cleanly farmer gets no better price for his produce than that obtained by the careless trader who covers his uncleanly methods by the use of preservatives.

The actual sterilisation of milk upon a large scale is not practised to any great extent in Dublin, but at Glasnevin, near to the city, a certain amount of milk is thus treated (*see* page 295). We obtained the views of the seven health officers already named, on the question of sterilised milk as an article of infants' diet. Drs. Garland and Quinn have no objection to offer to its use. Dr. Day advises actual boiling of the milk. Dr. Oulton is in favour of the boiling of milk, and Dr. Strahan is of opinion that it is better to boil milk than to stop short of boiling. Dr. Stritch has some objection to the use of boiled milk for infants. He prefers that the milk be pasteurised. He has witnessed bad results from the use of boiled milk. Dr. Crinion thinks that all milk should be sterilised. He has known many cases of diarrhœa to have been caused by sour milk, and has seen good results accrue in that disease from the use of sterilised milk. The boiling of milk is urged on householders by the Health Department of Dublin. It may, too, be mentioned that Dr. O'Dwyer, Health Officer of Tipperary, told us that in that part of Ireland but few mothers nurse their children. It is a common practice for mothers to boil the milk each morning, whilst the better class householders boil all milk coming into their homes.

In Dublin cows are stalled for 5-6 months each year, and in some few cases all the year round. The cowhouses are required to provide 500 cubic feet of air space per cow, and to be whitewashed in March and October. The Local Government Board for Ireland have issued model regulations for the use of local sanitary authorities desirous of regulating dairies, cowsheds, and milkshops in their districts, but we gathered that these have been adopted in a few instances only. There would seem at present to be very little control exercised as regards the sanitary condition of dairies and cowsheds in the country generally. It is in contemplation, Dr. Browne of the Local Government Board told us, to do something more in this direction.

At our request Mr. Watson kindly took us to see some Dublin cow-sheds which, he stated, were average types of such places in the city. One in South Dublin is registered for 24 cows. In the cowshed, which was very dirty, were 18 cows and 5 calves. The cattle and their udders were fairly clean, but as the cows were able to lie down in their stalls, opportunity was afforded them of fouling their udders. There was, however, a depression in the floor behind each for the droppings, and also a channel for carrying away liquid filth. The flooring of the sheds was good, but the open yard was cobbled, and on each side was an immense store of manure. The city water (Vartry) was laid on to a tap close to the sheds, which latter were, as is usual hereabouts, open on one side. Water was heated for the cleansing of milk vessels in a boiler in the kitchen behind the milkshop. No preservatives were, we were informed, used.

In another case in South Dublin we found the cows fairly clean, but the extremities of their tails were coated with filth. They had straw beds. There was a sloping surface behind the cattle, and the space on which they were standing was clean. But the surface on the other side of the shed was filthy with old manure, and here a horse was stalled. There was a central channel for the drainage of liquid filth, but the channel was rendered ineffective by stopping short of the drain connection outside the shed, and nuisance was thereby created. Mr. Watson had recently condemned the place on account of want of proper ventilation and sufficient air and cubic space, etc. The shed was open at either end, and contained about a dozen cows. There was a large accumulation of manure in the yard, draining to a trapped gulley, which was broken. The water supply was taken direct from a cistern which was used also for the flushing of the w.c. The owner said he always washed his hands before milking. The milk cans were generally washed in boiling water, but sometimes cold water was used. There was no boiler. Wooden tubs were used for the milking. The milk was set to cream in the shop. When we saw it the cream was standing in the close atmosphere of a living room behind the shop.

Bye-laws dealing with the personal cleanliness of dairy workers are now in operation in Dublin. Mr. Watson told us that in the dairies milk cans are usually cleaned with cold water. The washing of cows' udders is very little practised.

A milk vendor in the City informed us that the straining of milk both at once after milking at the farm and also on its arrival in the City is a general custom. In winter the milk is removed from the sheds to the yard for the purposes of straining. Milk is not cooled in Dublin, neither is this done in the country at all generally, save that in hot weather the filled churns are placed in cold water by the farmers. Mr. Stokes, of Limerick, informed us that the butter manufactory with which he is connected issue no regulations as to the cooling of milk. They are useless. Farmers will not cool the milk, and many will not even strain it.

During our stay in Dublin we had the benefit of conferences with the Right Hon. Horace Plunkett, President of the Board of Agriculture of Ireland; with Professor Carroll, of the same Board and superintendent of the Albert National Agricultural Training Institute at Glasnevin; and with Mr. Anderson, secretary of the Irish Agricultural Organisation Society, to whom passing reference has been already made. We discussed, *inter alia*, the past and present part played by co-operative societies in Ireland in connection with the dairying industry—an industry which Mr. Plunkett has done more to foster and improve during many years than can be easily estimated. Mr. Plunkett has, since our visit, addressed the following communication to the secretary:—

"Dublin, 25th October, 1900.—. . . . The purport of my reference to calving and winter dairying. . . . was that preservatives in Ireland were not called for in the winter; that too little of our dairying was done in that season; and that owing to the scarcity of labour and capital, the cultivation and extra shelter necessitated by winter dairying was probably the obstacle to a change. Danish dairying is mostly conducted in the winter, and no preservatives are there used.

"Personally, I am opposed to the use of preservatives in food. It is admitted that preservatives are added for the direct purpose of poisoning or inhibiting the activity of living organisms. It is true that a quantity which will affect this purpose in the lower organisms that produce decay in food stuffs is insufficient to visibly interfere with the functions of highly organised, healthy human bodies. The material must nevertheless be poisonous to living matter, or it is unworthy of the name of preservative. As I told you, preservatives in milk and cream disagree with me; but this may, of course, be an idiosyncrasy.

"But there is another important consideration which influences me in recommending that the use of preservatives in dairying be abolished. I am convinced that, in order to develop our dairy industry and to produce articles of first-class quality, the necessity for thorough cleanliness in all departments of dairying must be brought home to those engaged in the industry. But so long as preservatives are permitted as a substitute for cleanliness it will be impossible for our dairy instructors to make satisfactory progress. Briefly, the use of preservatives puts the careless and slovenly dairyman on a par with those who are careful and cleanly.

"I am quite well aware of the fact that, no matter how cleanly a dairyman may be, it is not possible to entirely avoid the presence of objectionable organisms in milk; but the recent developments and improvements in dairying appliances, particularly those for the pasteurisation and sterilisation of milk and cream, should amply meet all requirements and render the use of preservatives unnecessary.

"It has been argued that it is better for consumers to have milk free from bacteria and containing preservatives than to be supplied with milk undergoing decay. I wish to point out, however, that there is no record of persons having been poisoned by milk that has undergone change. On the other hand, in the neighbourhood of Glasgow and Edinburgh, there are a large number of dairy farmers who do not separate their milk, but who allow it to undergo fermentation and churn the whole mass. The milk is then sold in these two cities as an article of diet, which is much prized and, indeed, is regularly supplied at some of the best restaurants in Glasgow.

"I am of opinion that the dairy industry would be ultimately put on a better basis if the use of preservatives were disallowed. Butter-makers would then have to work up to a higher standard, and the improved quality of the produce, coupled with the knowledge that Irish butter contained no foreign matter, would unquestionably enhance its reputation.

"I am further of opinion that an interval of two years should elapse before the prohibition is enforced. This would be sufficient time to enable the butter trade of Ireland to adjust itself to the new condition of things.

(Signed) "HORACE PLUNKETT."

The growth of co-operative dairy societies and of the auxiliary stations in connection with them has been remarkable. Turning to the pages of the report of the Organisation Society just referred to, for the year ended March 31st, 1899, we find there the number of societies in existence on the 31st March in each year, 1895-1899, viz.:—

——	1895.	1896.	1897.	1898.	1899.	Membership.
Dairy Societies - -	56	61	83	123	153	20,844
Auxiliaries - - -	8	9	10	13	38	

As regards 1899 the distribution, membership, and trade were as follow, the trade figures representing only those societies which furnished complete returns:—

Province.	Societies.	Membership.	Trade.
			£
Leinster - - - -	21	1,547	37,110
Munster - -	64	5,773	247,345
Ulster - - -	76	6,903	63,922
Connaught - - -	30	6,621	52,937
Totals - -	191	20,844	401,314

The total capital invested at the end of 1899 in co-operative dairying was £166,558. The societies in that year received nearly twenty-three and a quarter million gallons of milk, from which they produced nearly nine-and-a-half-million lbs. of butter, or 4,177 tons. The farmers supplying milk realised an average price of 3½d. per gallon, the separated and butter milk being given back to them. Milk payments absorbed £354,596, and working expenses amounted to £46,081—roughly 11½ per cent. on the value of the output, which realised the large figure of £401,771. A net profit of £6,176 was earned on the year's trading. This is available for allocation among the members of the societies. The reserve and accumulated profit amounted to £13,648. The price received for butter was 9·83d. per lb.—a shade less than the price received in 1897, which was 9·89d. The average yield of butter from the milk was, however, a record, 6·46ozs. being produced from a gallon. At the time of our visit the societies had further increased to 240 in number, with an invested capital of £200,000, and an annual trade turn-over of upwards of one million pounds sterling.

It is to be noted that the Organisation Society deplore the scarcity of well-trained creamery managers and dairymaids. Dairy inspection and technical instruction are, however, in progress. The report already quoted says:—

"The reports of the Government dairy instructors and of our own inspector show that the creameries are becoming more alive to the necessity for scrupulous cleanliness, but in some cases this important detail does not receive the consideration which it is entitled to. A placard giving instruction to visiting committees of creameries has been issued to the societies calling attention to this matter, and also to the very important question of a good system of drainage, so as to avoid the risk of contamination by bad odours."* (*See addendum.*)

Sir Charles Cameron was good enough to take us over the Albert Institute at Glasnevin (to which we have already made reference), in company with the manager, and it may not be out of place to state here the main objects of this institution, bearing as they do very closely on the purpose of our visit.

The Institute is owned by the Government, and was built in 1839, though the present dairy building was erected only in 1881. The Institute was under the Commissioners of National Education until April last, when it was taken over by the new Board of Agriculture. The primary object of the Institute was to train school masters in dairying and farming as well as in literary subjects. When the Dairy School was attached in 1881, female pupils began to be received.

The Institution is designed to supply instruction:—

(a.) In the science and practice of agriculture.

(b.) In the most improved systems of dairying.

Training Institution.—The Training Institution is situated on the farm. The buildings comprise dormitories, dining hall, lecture and school-room, museum, library, and laboratory; and an extensive range of farm offices and dairies fitted up with improved machinery and implements.

Farms and Gardens.—These are situated about three miles north of Dublin, and one mile from the village of Glasnevin, and contain about 180 statute acres, distributed as follows:—

(a.) An area of four acres (statute) is cultivated as a small spade labour farm, with the view of exhibiting a proper system of cultivating the vast number of small farms in Ireland. (b.) An area of 22 acres has been set apart as a farm of intermediate size, with a view of illustrating a system of farm management adapted to the circumstances of farmers whose holdings are large enough to give employment to one or two horses. (c.) The remaining portion of the land forms one large farm.

Only five cows are kept at farm (a.), 10 cows at farm (b.), and 30-40 cows at farm (c.); the first (a.) is set aside for the purpose really of affording an "object lesson" to those school teachers who desire to learn how to manage a small farm, and then return to their scholars with practical information.

The teaching arrangements afford to the students as large an amount of information as possible upon every branch of the business of farming, *e.g.*, dairy husbandry, the fattening of cattle, the breeding and rearing of different kinds of live stock, the various operations of field culture, the permanent improvement of the soil, etc. The instruction is further eminently practical, the students being called upon to take part, for a limited time, in the performance of every farm operation.

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* *Among the leaflets which the society have distributed are the following from the "Technical Instruction Series":—Instructions for sampling and testing milk and cream, cream separation, ripening and churning, co-operative dairying, auxiliary creameries, home rule in the dairy, pasteurisation of milk and cream.*

As regards female dairy students, some 60 of whom enter each session, and creamery managers, of whom about 20 enter each session, the following regulations obtain :—

Dairy Students (Females). (Fee, £3 for each session of six weeks; two sessions each year.)—Admitted for instruction in dairy management. They are at all times under the supervision of an experienced matron.

The course of training embraces—

(a.) Instruction in the principles of feeding cows, calves, and pigs; the treatment of milk and its products; and the management of poultry.

(b.) The practice of dairywork. The making of butter and cheese in large and small dairies, both with improved machinery and implements, and also with ordinary appliances.

(c.) Such other subjects as may be determined by the Commissioners of National Education, including needlework, cookery, etc.

The admission fee covers the expense of board, lodging, washing, and medical attendance.

Examinations are held at the end of the sessions, and certificates awarded to proficient students.

Creamery Managers. (Fee, £3 for interns, £1 for externs, for each session.)—Young men employed in, or about to be employed in, creameries, are admitted for a five weeks' course of instruction in dairying, which begins on 1st March each year.

The course of instruction embraces :—

(a.) Dairy science, including the analysis of milk, buttermaking, and cheesemaking.

(b.) The preservation of the health and the feeding of dairy cattle.

(c.) Practical dairywork.

(d.) Theory and practice of book-keeping and accounts.

After the expiration of six months from the close of the session certificates are granted on the following conditions :—

(a.) That the student has attended the full course, passed a satisfactory examination in general dairy practice, and shown proficiency in the management of appliances for making butter and cheese.

(b.) That a favourable report has been received from the Creamery Inspector upon the creamery with which the student is connected, in respect of cleanliness, tidiness, and efficient working.

In addition, there is a farm at Limerick, whereat pupils practise creaming, etc., in order to give them larger experience in butter-making than the farms at Glasnevin afford.

The Munster Dairy School and Agricultural Institute at Cork is also owned by the Government, and provides classes, practical demonstration, and instruction on much the same lines as the Glasnevin School. Skilled instructresses are sent from the Albert and Munster establishments wherever their services may be required under the following conditions :—

1. That a small local committee shall be formed, who will provide, free of cost, a suitable building, such as school-house, barn, or dairy, where practical instruction can be efficiently given. 2. That a sufficient supply of pure water and means of heating same will be available. 3. That a sufficient quantity of milk or cream will be available. 4. That all necessary steps will be taken to make known throughout the district the intended holding of the dairy classes, and an endeavour made to secure the attendance of an adequate number of students. 5. That an active woman will be engaged by the local committee to attend the instructress during classes, for washing the dairy utensils. 6. That in each district, where practicable, a committee of ladies shall be formed, these ladies to exercise care over the classes, and to see that suitable lodgings be provided for the instructress.

The application for the services of dairy instructresses must be signed by at least six farmers, who must be responsible for the fulfilment of the preceding conditions.

The dairy instructresses may also be sent to any district upon an application to be signed by at least six farmers, for the purpose of visiting the dairies, pointing out mistakes, suggesting improvements, and making butter with the utensils, or other simple appliances found available.

There are also male dairy instructors, who visit creameries, etc., and make suggestions as to improved methods of dairying, butter-making, etc.

At the Glasnevin Institute, the whole-milk from the farms is mostly sold in Dublin, only the surplus being used for butter-making. The cows are milked about 5 to 6 a.m. for the morning delivery, and about 3 p.m. for the afternoon rounds. It is the experience there that the older cows give the richer milk, but in less amount. Cows' udders are rubbed with a dry cloth, when the cattle are stalled. The hands of the milker are always washed immediately before milking, and as often as possible during the process. The cattle receive great attention. Milk vessels are cleansed by means of water heated by steam, and the milk itself is filtered through cloth and a special strainer. The cow-house is 100ft. by 30ft. by 14ft. high, and gives 1,000 cubic feet of air-space per cow. It has eight windows, 14 special ventilators, and five doors. There is a sunk trench for cow droppings, effective drainage for liquid filth, and the manure is pumped from the adjoining yard on to the farm fields. Each cow has her own water trough. The cows are in the fields from 10th May till mid-October, and during the remaining portion of the year the cows in calf are exercised daily, the time during which they remain in the open being regulated by their own inclination. As soon as they desire to return to the shed they are permitted to do so.

Some of the milk at the Institute is sterilised, after having been filtered through a cloth. The bottles in use for such milk are first heated to 212deg. F. They are then filled with milk and raised to a temperature of 196deg. F. in a steam auto-clave. The glass and rubber-band corks are automatically closed by a very ingenious arrangement, and water is let into the auto-clave until the temperature has been reduced to 60deg. F. The water is then drawn off, the bottles uncorked, and the milk heated up to 212deg. F., after which the bottles are again closed, and the milk once more cooled down to 60deg. F. Milk thus intermittently heated is found to keep for an indefinite period. It darkens in colour a little.

At the Glasnevin Institute butter is only made from surplus milk from the city rounds. The milk is separated, after being heated in an ordinary Pasteurising apparatus to 160deg. F. The milk is only momentarily at 160deg. F. Some of the milk is set in flat, tinned-iron pans, and the cream resulting is hand skimmed. The milk has been previously strained, but not cooled, at the Institute farms, which, however, are close at hand. The milk setting room has windows that open wide, and are fitted with gauze blinds for use in summer. If the heat is too great, the windows are closed and the panes syringed with cold water to keep the room cool.

The cream taken from the pans is placed in a can, and this again in cold water in summer, and in warm water in winter. Very little ice (some half a ton) is used during a year; cold water suffices for all purposes. The cream is cooled to about 60deg. F., and all the skimmed milk is used for cattle.

The butter is sometimes made entirely without salt; and in other cases is salted to local taste. A great many people are said to prefer butter made with ½oz. of salt to the lb. Only 50 to 100lbs. are made daily, more for purposes of instruction than profit.

The Institute possesses a "Radiator" which is used on an emergency for the manufacture of butter by one continuous process. It is the Aktiebolaget Radiator of Stockholm. But it can deal with only 50 gallons of milk per hour, as against 400 gallons in a complete set of ordinary butter making plant.

We visited the Lucan Dairy premises in Dublin, and also one of the two farms owned by Messrs. Nash, situate at Lucan, ten miles out of the city. The farm is large, with some hundreds of milch-cows. The hours for milking are in the early morning, and from 5 to 6 p.m. Calving is regulated, so that the cows calve about October, just as they are going into their winter quarters. The cattle are let out each day in winter for a couple of hours if at all practicable. Natural green food is given them during the winter months. The tuberculin test is applied whenever deemed necessary. Each milker has his own cows to attend to. He washes his hands before he begins to milk, and as often as he can be got to do so during the operation. Stalled cows have their udders dry-rubbed. The milk immediately upon being drawn is strained through three layers of cloth and a metal screen, and in winter is at once removed from the sheds. In summer the cows are collected at different parts of the fields, and milked there until the grass has become soiled. Each cart as it is filled with cans is sent to town. The railway transit is very good on the Great Southern and Western main line. The cattle which we saw in the fields were very clean. They were of varying breeds, Dexter (one gave 4-5 gallons of milk daily), Kerry, ordinary Shorthorn, Ayrshire (best milkers), and Poll Angus (the smallest yielders of milk).

Milk cans are rinsed with well water at the farm. The cowsheds are whitewashed three or four times yearly, a man being employed at the farm for the purpose of painting and whitewashing. One shed which we measured was 105 feet long. It was stalled for 31 cows, each beast having a space allotted to her of 16 feet long by 3½ feet wide, by 11 feet high, giving her 616 cubic feet of air space. The shed had ten roof ventilators, always open, and two doors. The stalls were disinfected with Jayes' disinfectant when necessary. There were trenches for cattle droppings, and effective drainage for liquid filth; manure was frequently removed to the large open space in the form of a quadrangle, along the sides of which the cowsheds were disposed.

A veterinary surgeon examines all the cows every two months or so, and any which may be out of health are isolated. No infectious disease has ever, it is stated, been found in milkers or their families. If it were found, the milk would not be used till all danger of infection had been removed. The firm have a medical adviser of their own; but no printed regulations as to milk supply.

Ninety per cent. of the milk dealt with at the dairy premises in Dublin comes from the two farms belonging to the firm, ten and thirty miles away respectively; the remaining 10 per cent. comes from small farms, where, as is the case at the other two farms, cans are rinsed in cold water. On the dairy premises in Dublin the cleansing of the cans is accomplished by hot water and mops, and by steam under high pressure. The lids of the cans are cleaned with a hand-brush.

All milk sold by the dairy, viz., some 1,300 to 2,500 gallons each day, is pasteurised. The milk is retailed at 1s. 4d. per Imperial gallon. It is some ten years since the milk was first pasteurised in response to a growing demand for good milk. No preservatives of any kind are used in the produce passing through the dairy, and no difficulty has been experienced in dispensing with them. They were used years ago; but have been discontinued for a considerable time. No bottled milk is yet sold, but the use of bottles is in contemplation. The firm does not, however, regard the bottling of pasteurised milk as a necessity. It may be mentioned that Mr. Nash has patented a churn with a close fitting lid, into which milk after pasteurisation can be passed without becoming contaminated by the air. The closely-fitting lid is so arranged that all air taking the place of the milk drawn from the churn tap must have first filtered through dry wool, the air originally in the empty churn having been sterilised. From this churn, householders could be furnished with pasteurised milk in the same manner as they are now supplied with fresh milk, and big establishments, such as hotels, etc., could be provided with a churn for their own use.

On receipt at the dairy, which is under the management of Mr. J. Craig, the milk is strained, filtered through two linen cloths, and then passed through a separator to be further cleansed. The cream and separated milk are then re-united, and pumped up to a pasteuriser, where they are heated to 165° or 170° F., for half an hour. In the next place, air which has been filtered through hemp and wool is forced into the milk at a temperature of 170°. The aërated milk subsequently passes into a can through a gauze bag, this latter contrivance preventing the milk becoming "churned" by its fall.

As regards the butter-making section of the dairy, the cream is separated at 167° F., and the separated milk is also pasteurised and sold. The firm make their own butter starters, Hanson's lactic ferment being added to sterilised skimmed milk, and the starter prepared in the usual manner. The cream stands thirty hours before being churned, eighteen of which are after its inoculation by the starter.

To prevent waste, skimmed milk and any surplus of new milk are mixed and churned. Some butter results; but the churning is really done to obtain the buttermilk, which is in demand, and contains 0·6 per cent. or more of butter fat.

The butter when removed from the churns is placed in ice-water before being worked, and two to three per cent. of salt added before the water it contains is expressed. From 1·75 to 2·0 per cent. of salt are regarded as remaining in the finished article. After washing, the butter is stored in ice-chambers in bulk till next morning, when, being firm, it is made up into ½lb. and 1lb. packets, and again placed in cold store till sent out. It is all sold in Dublin.

The cream which is to be potted is also kept one night in cold store. It is all sold by dairymen, about 25 gallons daily.

Sir Charles Cameron told us that preservatives had been found in cream vended in Dublin (the Lucan Dairy not being in question), and we found one dairyman in the city who admitted the use of "Articanus" for cream ordered in large quantities. Mr. Anderson informed us the Irish Agricultural Organisation Society have found preservatives in cream vended by grocers in Dublin.

As regards colouring matter Sir Charles stated that the common agent used, whether for milk or butter, is annatto. He thinks that no deleterious colouring matters are now employed.

A Source of Cream Supply to England.

We visited one large inland establishment whence cream is and has been for twelve years past sent to England in amounts varying from three to twenty churns three times a week all the year round. The milk for creaming is obtained from some 200 farms in the neighbourhood, none being more than six English miles distant. The establishment is very strict as to the condition of farmers' churns, and the farms supplying milk are regarded as being as clean as any in Ireland. The farms seen on our drive of many miles to and from the establishment, however, sufficed to indicate that, as we found elsewhere in Ireland, there is room for much improvement in this direction. Milk is strained on reaching the establishment and tipped into a measure. It arrives to the amount of about 5,000 gallons daily from 7 to 10.30 a.m. A sample of each farm's supply is taken, and the average amount of fat in a month's composite sample forms the basis of payment to the vendors. From 1,200 to 1,400 gallons are separated each hour at 152° F. by "Alpha" separators. The separated milk goes back to the farmers. The cream is not as a rule cooled, but it is placed in cold water tanks in hot weather, large churns being used. These churns are washed in soda and water and left for next day's use, prior to which they are re-washed with the aid of steam.

The cream is sent 7½ English miles by road, in open carts, covered with sheets, the journey being made slowly, and occupying three hours. Thence by rail to Cork, and by steam packet to one of the English Channel ports, and again by rail inland, taking two days in transit, and arriving "to all intents and purposes" sweet at its destination, where it is pasteurised, where "some preservative may be added," and whence some issues in brown jars, and some in tins, much of it finding its way into grocers' shops, big hotels, etc.

As regards the treatment of the cream in Ireland there is clearly a suspicion that the farmers may at times add preservatives to the milk sent to the central establishment to be separated. The analyst told us that some farmers do, as a matter of fact, use them. He submits samples to the action of bi-chromate of potash, amyl alcohol, and sulphuric acid, and he says that the behaviour of certain samples in comparison with that of others leads him to the conclusion that occasionally a foreign substance is added by the farmer. He thinks there is some chemical combination which takes place He finds these differences in summer more than in winter.

With respect to the treatment of cream before it leaves the establishment, we were variously told that the use of preservatives had been dispensed with both in summer and winter: that formalin was once

Appendix.

used, but is not used now; that preservatives were tried and did not answer; and that some method of chemical preservation, the secret of the manager, was now in use, unvarying in winter and summer.

The use of Preservatives in Butter.

With reference to the use of preservatives in butter, we obtained a good deal of information from several different sources. In the first place, we learned from Mr. Anderson that butter which secures first prize at the Irish butter exhibitions is never preservatised. He deems preservatives, as we have said, to be unnecessary for butter or milk. On the other hand, Alderman Dale, of Cork, who is President of the Butter Merchants' Association, still holds the view expressed in his evidence before the Committee that butter that has to be kept must be preservatised in some way. Mr. Thorp, of Limerick, an expert on butter, thinks very little difficulty would be felt in the Irish trade if the Committee's findings led to the prohibition of boracic acid. In his view the absence of a definite pronouncement on the matter is the real trouble; that the laying down of some absolute requirement is what is needed, and would suffice as long as pasteurising is practised. He regards the use of preservatives to be wrong in principle, and opposed to the interests of the public health. Mr. Roche, of Limerick, who is intimately associated with Mr. Plunkett in agricultural reform, is of opinion that three years should be allowed to elapse before the actual coming into operation of any law prohibiting the use of preservatives in butter. They can be dispensed with, and "their prohibition would wipe out the dirty farmer," whose withdrawal from the butter industry would be in the best interests of the country. The present condition of dairy farming in Ireland renders preservatives necessary, and he (Mr. Roche) is well able to judge of the ability of Ireland to do without them since he has opportunity in his business relations of seeing butter coming from one hundred creameries; while as regards quality, he has the judging of the output of about two hundred creameries. His experience of the creamery system of the country has extended over five years.

Prof. Carroll told us that the farmers on the hills do not use "preservatives," but a "hot pickle" and much salt. Mr. Lough, of Killeshandra, has been sending butter to England for some years with less than one per cent. of salt, and without any other preservative whatever. Such butter is much in demand.

We spent some time with Mr. R. Gibson, salesmaster in Limerick Butter Market, and himself a vendor of preservatives. He showed us butter from various parts of the district, near and far. The following is a copy of notes taken at the time of our conference with him:—(1) Butter sent from East Kerry, with 3lbs. of salt and $\frac{3}{4}$lb. to 1lb. of preservatives to 112lbs. will keep perfectly well for a fortnight, a time quite sufficient for all trade purposes. (2) Butter from co. Tipperary, made by a Dane, without salt, with 1lb. of preservatives to 112lbs. will keep a fortnight. (3) Butter from West Kerry, without preservatives, but with 3 per cent. of salt, had already begun to go off, being only three days old. This latter butter was not sold; merchants have been shy of buying it. Butter from near Tipperary town, with 1lb. of preservatives and 3lbs. of salt to 112lbs. (5) Butter made by farmer with his own separator. No steam power. The farmer earns more money by making his own butter than by sending his milk to a creamery. One small farmer makes £9 a week during nine months in the year out of a weekly output of 224lbs. of butter plus his butter-milk. (6) Butter with 1lb. of preservatives to 112lbs., but without salt. Said it would keep a fortnight. We did not like its taste. (7) Butter from a farmer 23 miles away on the hills in co. Tipperary made from skim milk without preservatives, and 4-4$\frac{1}{2}$ per cent. of salt. We did not like its taste. (8) Blended factory butter made with 5lbs. of salt and lb. of preservatives to 112lbs. of butter. Will keep at any reasonable temperature for three months, and still retain its original flavour.

We saw blended butter being worked up, after having been table-worked, by platter and hand, to still further express the butter-milk. All tub butter coming into Limerick is scraped to clean its surface. The scrapings are melted by Mr. Gibson and churned into butter, perfectly flavourless, for use in confectionery. Without the use of preservatives this butter would, Mr. Gibson stated, turn rancid.

Another butter seen was made by a farmer with a hand separator and yet another was an imperfectly worked butter presenting a streaky appearance, and this butter sold for 1d. per lb. less in consequence. The streaks indicated that neither the salt nor the preservatives were uniformly mingled throughout the butter substance.

As regards the use of hand separators by farmers, Mr. Gibson told us that farmers make some 30s. per cow per season more if they separate their milk for butter making on their own premises instead of sending it to a creamery.

The Keeping Powers of Irish Butter.

On the vexed question of water in butter as affecting its keeping quality and its weight, Sir Charles Cameron holds that anything over 16 per cent. is excessive, and advises proceedings against the vendor. The Dublin Bench convict when over 18 per cent. of water is found. Sir Charles gave us the following data obtained from a series of experiments conducted in 1894, as regards the proportion of samples of tested butter yielding over 16 per cent. of water from each of the four provinces:—

Munster -	- 604 samples -	- 42·4 per cent.
Leinster -	- 179 ,, -	- 13·4 ,,
Ulster -	- 50 ,, -	- 8·0 ,,
Connaught	- 52 ,, -	- 17·3 ,,

Mr. Stokes, of Limerick, regards upwards of 15 per cent. of water as detrimental to the keeping quality of butter; whilst Mr. Gibson went so far as to say that 17-18 per cent. is needed to keep salt in proper solution.

On the subject of the keeping quality of Irish butter, Mr. Anderson maintains that ordinary butter will keep as well as butter made from pasteurised cream if the cream be churned at the proper degree of acidity.

Alderman Dale thinks Irish butter has keeping properties equal to that of Danish, but it has not the same ready sale. Ireland "lost the market" before preservatives began to be used; the non-use of preservatives would, he alleges, lead to the flooding of the market at certain times of the year.

Mr. Stokes, of Limerick, tells us that creamery butter will keep for a month—that is, twice as long as trade purposes require. But Mr. Roche thinks a month requisite for the trade. Mr. Gibson says farmers on the hills keep their butter from July to the succeeding January, and then get top prices for it. A butter merchant informed us that he had purchased butter that had been stored for months under the beds in farmers' houses to avoid theft, which would probably have occurred had the butter remained in an outhouse. Some of these farmers, he says, only get to market three or four times a year, and could not cart their milk to a creamery. Professor Carroll, however, sees no difficulty in the way of transport; the butter held up in the way described is, he stated, very heavily salted, "hot pickle" being used for the purpose.

Mr. Lough, of Killeshandra, keeps butter in his cooling chamber at a temperature of 35° F. for eight days in hot weather, and then disposes of it. It sells as well as perfectly fresh butter, and is sent to London, a journey of two to three days.

With regard to cooling chambers for butter storage, at Cork we went over the Cork Ice Company's premises. This company has a large cold store for butter, and makes daily 6 tons of ice, 10 cwts. being turned out every two hours in cwt. blocks. The ice, which takes 24 hours to prepare, is extremely clean and transparent. The machinery is worked by electricity, and the water used is that supplied to Cork, but specially filtered. There is a winter store of 300 tons, and 40,000 cubic feet of storage space. One chamber is kept at 25° to 28° F., and ice and butter alike are stored therein; other chambers are at lower temperatures. There is non-conducting material in the double walls, and also 1$\frac{1}{2}$ inch of air space left free. Creameries also purchase the ice.

The Condition of Irish Farms.

The condition of the farms generally in Ireland, so far as we saw them—and we saw many in various parts of the great butter-making counties in the south-west and south of Ireland, and in the county of Cavan—was in no sense creditable from a sanitary standpoint. The examples of cleanliness were few and far between. Save in extremely few cases, the bedding in the sheds was old and offensive, both in those cow-houses which were totally covered and walled, and in those which were partly open. The accumulations of manure in the yards gave evidence of long standing. In farms whence butter was being sent to market, creaming room and churning room alike were often in a by no means cleanly state. One very significant statement, made to us at times, was that the creameries do not know the conditions of the farms from which the milk received by them is brought. Nor do the factories know under what conditions the butter is made which comes to them for blending or tubbing. Neither could we find that much thought had been given to the question. Hence farmers have not had the incentive to cleanliness which would have been given if adequate inquiry had been instituted by creameries and factories into the actual state of farms sending milk or making butter, and if pressure to rectify offensive conditions had followed such inquiry and preceded acceptance of produce. The fact remains that those farmers who have been careless in regard of cleanliness and of the sanitary condition of their premises have in no wise suffered in a monetary sense. As an example, we may say that, perhaps one of the worst instances coming under our notice was that of a farm using the most antiquated methods, and yet this farmer obtained the top price in the local market for his butter. We do not say that all creameries and factories alike are negligent of regard for the source of milk and butter received, but the rule holds good generally. This is not the case with reputable firms vending milk as such.

We quote notes taken of the state of a few of the farms seen by us in sundry districts during our stay:—

(1) Farm, near Limerick.—60 acres, 23 cows; £25 given for hand separator. Now making 168lbs. of butter per week, salt and preservative mixture supplied by butter merchant; 2lbs. of mixture used to 56lbs. of butter. Water supply from pump in field near by. Mouth of well raised above level of ground. Cowshed very dirty, floor being littered with filth. House in which the milk is separated and butter made, deplorably dirty.

(2) Another Farm near Limerick.—200 acres, 27 cows, 185lbs. of butter made per week. Price better by 21s. per cwt. now than when the cream was sold instead of using a hand separator. Latter cost £26. Calves also better now that the farmer is able to give them skimmed milk quite fresh. We were informed that about 0·8 per cent. of butter fat was left in hand separated skim milk, and 0·2 per cent. with the Alpha separator. Separator cleaned twice a day, and milk strained into a tub immediately on being drawn; milk twice strained, and still dirt left in it. The farmer gets 20 per cent. more butter than when he allowed the milk to set and hand-skimmed it. In the season he finds a difference of £2 per cow, whether milk be sent to a creamery, or made by himself into butter, in favour of the latter. He has to get his water from a distance of 500 yards, and to water his cattle 400 yards away in another direction at a stream. It takes half an hour with donkey traction to get a tub of water from the pump. His custom is to keep and to milk his cows in the open during nine months of the year, confining them to their stalls during the night for the remaining three months. In winter, milking is done in the sheds, but he does not believe in shed milking. The conditions of this farm were distinctly above the average.

(3) Farm near Tipperary.—A farm of 50 cows, where the farmer makes his own butter in summer, but at the time of our visit he was merely sending the milk to a creamery. The churning and creaming room has a cemented floor; all contents very clean; but room opens from the large living room.

(4) Another farm near Tipperary, where butter which fetches top price of £3 3s. per 70lbs. was being made and sent into the Tipperary market; the churn was being worked by a donkey. Milk set for creaming under very dirty conditions, the smell of the house being foul, and the dirty water on the floor adding to the foulness. Owner uses 3lbs. of salt and ¾lb. of boracic acid* to 70lbs. of butter. In the heat of summer, a preservative is used both for the milk before setting it to cream, and for the butter when made. No preservative used in winter. The butter will keep for twelve months, even without boracic acid. The whole place was indescribably dirty.

(5) Farm near Limerick Junction.—There are 64 cows, and the milk is sent in to a creamery once a day, the evening milk being set in churns in a cold water tank in the yard. Cows are in the sheds from January to May, but are exercised every morning for a few hours when weather permits. Cowsheds were somewhat cleaner than in general, and had the usual permanent side openings. No preservative is ever used in milk.

(6) Small farm near Tralee.—Farmer keeps 20 cows; butter sent away fresh, without salt, to Tralee, once a week. Cream set in shed with dirty floor. Bird and poultry dropping, etc., on floor. Butter washed three times in water.

(7) Farm near Tralee.—Farmer keeps five cows; butter sent to local customers. Very dirty floor to storehouse for setting cream and for butter making.

(8) Farm near Tralee.—Farmer keeps 49 cows; makes his own butter, which is sent to England through an agent. Uses a handful of preservative to 56lbs. of butter, and 2lbs. of salt; and sometimes sugar also. Very dirty cowhouses, wherein the cows are always milked, and house for storing cream and for making butter also very dirty. Stone flooring to store room. Farmer strains the milk and cools it by water in the sheds. Water from well.

(9) Farm near Tralee.—No preservatives used, but 3 per cent. of salt. The cream is left on the milk till the milk turns sour. Farmer churns twice a week. The cream is kept a week in winter or till it goes sour. The creams of different days are mixed, each three days' cream together in summer, and each six days' in winter. The resulting butter is regarded as of first quality in Cork Butter Market. The butter is known to go to England also. He gets the best prices, and no complaints have been received. It goes first to Tralee, but is not blended. The milk for creaming is strained immediately after being drawn, and is taken from the cow to a large tub, where it rests for an hour. It is then left in the setting pans. The screening is done through muslin over a metal-gauze strainer. The butter is worked by wooden platters. The water supply is from a well a quarter of a mile away. The water in the house is not fit for domestic use, or for butter making; it has too much iron in it. The cows are milked in very dirty cowshed, but with plenty of air space round it. The shed has a wooden roof, and was covered with cobwebs. The floor of the shed in which the cream sets was dirty, but concreted. The shed was clean. The open yard was dirty with old manure, and there were recent cow droppings. Milk vessels are cleaned in boiling water, in a boiler in the house, for 20 to 30 minutes, and then dosed with salt, and rinsed with cold water. The butter will keep for three weeks with only 3 per cent. of salt in it, even in the heat of summer. No preservatives were used.

The farms seen on the way to Belturbet from Killeshandra in Co. Cavan were very dirty, both as to sheds, mud floor, yards, and milk storehouse. We saw several of them, and all were alike in the matter of filth. And this despite some attempt on the part of the creameries hereabout to get the farmers to adopt habits of cleanliness.

We inspected one of Mr. Lough's cowsheds near Killeshandra, at 9 o'clock one morning. The cows had, as usual, been milked in the shed in the early morning, and the droppings of the cattle had not yet been removed. But the shed was well arranged and ventilated, and had at the time the smell of a well-kept cowhouse. All manure is removed as one of the stableman's first duties each morning, but on this occasion the shed had been left as we found it until our inspection was made. The milk of each cow is immediately removed from the shed, which latter has its wooden stall sides white-washed frequently, as often as once a month in winter. The floor of the shed is constructed of wood beneath the forefeet of the cattle, and of concrete under their bodies. There is a trench for the droppings and liquid manure.

Certain Considerations Relative to Irish Dairying.

Before proceeding to describe the methods adopted at the several provincial creameries and butter factories in relation to preservatives, it may be well to refer to a few expressions of opinion which we heard with regard to the pasteurising and sterilising of milk, and as to the regulation of calving, and of winter dairying. Mr. Thorp, of Limerick, regards the sterilising of milk as producing a bad flavour in the milk, whilst if pasteurisation were made compulsory all the creameries in the South of Ireland would, in his opinion, need to replace their plant. This statement seems to us to require some modification in view of the fact that pasteurising is already—though certainly to a limited extent—practised in the South. Professor Carroll is of opinion that the practice will grow. Alderman Dale and others told us that, as a general rule, calving is not regulated in Ireland. There is lack of organisation. Here and there we found some attempt being made, and again, firms which deplored their inability to secure co-operation in this matter on the part of farmers, occasionally set the example as regards their own local herds, as in an instance to which we refer later, near Waterford. Moreover, great hopes are entertained that the new Board of Agriculture will do something to foster the practice. With regard to winter dairying, for an extension of which in Ireland great need exists, Mr. Shanahan, of Cork Butter Market, told us that there is abundance of grass from May to October; but that farmers let their cows run dry when food becomes more expensive, attaching more importance to the extra cost of winter feeding than to the profits of butter making. A little inferior butter, he says, is made as late as December, and then practically none till April. In the county of Limerick, with the richest land in Ireland, the creameries have, he remarked, to be closed from November to April in each year because of the scarcity of milk. Yet at a farm making its own butter, near Limerick, we were told by the owner that on food costing 8d. per cow per diem his cows produce four gallons of milk all the winter. And Mr. Roche, of the same town, states that winter dairying is on the increase, especially in the North.

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* *The boracic acid had been sold to the dairymaid as butter powder, "containing no acid."*

It would appear to be a widely prevalent opinion that Ireland is losing much to-day by reason of lack of initiative on the part of her farmers in the direction of regulated calving and consequent winter butter making. The Irish Agricultural Organisation Society is doing good work in these matters, but the hearty co-operation of the large numbers of cow-keepers who at present are inactive in this regard is needed to place the butter industry of Ireland on a better and more secure footing. The small amount of winter dairying in itself tends to prolong the necessity for a "keeping" butter which consignees of Irish manufacture have come to look upon as a natural produce of the country, and hence the use—as we were generally told—of chemical preservatives.

It will be seen from the following examples how varying are the methods employed, quâ preservatives, in the manufacture and blending of butter in Ireland. The practice in this regard varies from the entire absence of preservatives in butter made from unpasteurised or pasteurised cream to the addition of as much as ¾ per cent. of such preservatives. Messrs. Cleeve, coming between the extremes, use only ½oz. for each cwt. of butter at Tipperary, and through the major part of the summer none at all. Again, it will be noticed that in the past very much larger amounts of these substances were added by certain of the manufacturers than is the case now; no inconvenience is found to attend the use of the smaller quantities. One firm declared that for some seven years no preservative whatever was used by them, then two or three per cent., and now less than one-half per cent. We think these facts need but little comment.

Notes as to Creameries and Butter Factories.

I. A Creamery at Tralee.—The milk is brought into the town in wooden buckets by donkey cart. The buckets have wooden lids, which are enveloped in a linen cloth, and by this means are made to fit tightly. Ordinary churns are occasionally used. Milk arrives during the morning, about 120 carts coming distances of some three miles on an average. Only whole milk is dealt with. Each farmer's milk is separately weighed before being passed through the strainers into the general supply contained in a drum-shaped receptacle. The milk from this drum passes into a tank, and is warmed in winter time up to about 80° F. to facilitate the separating process. In summer the natural heat suffices. Its temperature upon arrival at the creamery building has been known to be over 70° F. The milk on the day of our visit was 76° F. The milk which is brought each morning to the creamery consists of the same morning's and the preceding evening's milk, the mixture between these two being effected at the farm. From this it follows that some of the milk upon arrival at the creamery may be sixteen hours old. The first strainer kept back much dirt, as did also the second (upper) strainer. A pocket knife and a watch, we were told, had been found in the first strainer on different occasions, and we saw, both here and elsewhere, ample evidence of the necessity for such straining. The milk is never cooled at Tralee, but the churns are during summer placed in cold water at the farms in the evening. There is no pasteurising practised. The cream is set for 24 hours in cold water tanks, and then churned, the act of churning occupying about half an hour. No salt is added for mild butter intended for Bradford, Southampton, and the local trade; but ¼ per cent. of boracic acid is used, even in the heavily salted butter (3 per cent.). Pure boracic acid is used mixed with the salt, the mixture being applied by hand. The dairymaid stated that as she was able to exactly estimate how much she is adding, she does not weigh the actual mixture. She takes three handfuls to 56lbs. of butter. We tested her ability:—

First time - -	3 handfuls - -	1½ lbs.
2nd ,,	,,	1⅝ ,,
3rd ,,	,,	1¾ ,, full weight.*

The butter is never handled. Some 13 to 14 per cent. of water is left in the finished product. Butter sent out on Saturday would be in consignees' hands in England on Monday evening. It can be in England 24 hours after making. It will keep unsalted for 14 days, and for a month if salted, assuming that preservative be added in each instance. No butter is sent out without preservative. It would "go off" after four days.

The separated milk is weighed and returned to the farmers, 10 per cent. being deducted for cream taken for butter-making. The farmers are paid for their milk on the average of butter fat in each month's milk as ascertained by multiple samples.

The well is in the yard. Its water is used for cleaning cans. The well is open to surface pollution, and is dangerously near a manure heap.

The farmers, we are told, cleanse the milk cans in boiling water.

II. A Butter Factory at Tralee.—In the factory butter 6lbs. of salt are added to 70lbs. of butter. There is no blending of salted butter from the farms. The only blending is of unsalted butter bought in the usual markets and coming in an unfinished state. Preservatives and salt are used in factory butter after its arrival at the factory, and it is alleged that neither are added prior to this. The unfinished butter arrives from the farms in tubs or firkins, and as an example of the common practice we were told of a farmer who, by means of two churnings, is able to fill a tub each week. The butter is classified, and the classes blended, each class by itself. There are two classes at this factory. Our visit being on a Saturday, no blending was in progress. The boxes in which the butter is bought in the markets are covered inside with cloth. The butter is sent in bulk in these boxes.

The butter-table upon which the butter is worked up was fitted with a large tooth comb used for freeing the butter from hairs, etc. Butter is worked for six minutes, 5 cwts. at a time. The factory now uses ½ per cent. of boracic acid in place of 1 per cent. which was formerly added. Salt and the acid are mixed, and put in after weighing. The acid costs 29s. 6d. per cwt. (5 cwts. bought at a time), and 1lb. of boracic acid goes to 14lbs. of salt. Each lot is measured. The colouring for the low class butter is Mallen and Co.'s, of Dublin, Patent Oleo Butter Colouring, and was, we were told, recommended by Professor Carroll. The butter to be coloured is left longer on the working table than if no colour be added, an extra three minutes being allowed.

III. Manchester Wholesale Co-operative Society, Tralee.—The Manager, Mr. Dawson, told us that no colouring is used in the butter. There is from 5 to 7 per cent. of salt in farmers' firkin butter. The creamery butter is bought from local creameries. Preservatives are used. The Society has here a creamery, factory, and butter agency in one. They put ¾ per cent. of boracic acid into factory butter, *i.e.*, ¾lb. of boracic acid and 2½lbs. of salt to 112lbs. of butter. Each 112lbs. of butter going on the table is estimated as such, but the mixture of salt and preservative is actually weighed. Some few years ago 2 per cent. of boracic acid was used; prosecutions in England led to a reduction to ¾ per cent. plus 2½ per cent. of salt.

The milk of each farm is tested daily. The milk is heated to from 100° to 110° F. before it is separated, and the skimmed milk is pasteurised before sending it back to the farmers. From 0·3 to 0·5 per cent. of butter fat is left in the separated milk. It is pasteurised to about 180° F, and the plant can deal with 800 gallons per hour. The milk is then cooled to about 60° F. The Society deduct 15 per cent. of the skimmed milk from the farmer in respect of cream taken. For the creamery butter no cultures are used, the cream being allowed to ripen automatically. The Society churn seven days a week. The cream stands 24 hours, before being churned. All vessels are cleaned by hot water. There is an ice-making apparatus, and in addition another machine for cooling water. The floor of the well-appointed buildings is cemented.

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* This same dairymaid could not in many instances tell the amount of butter going to 1lb. at all exactly.

In Mr. Dawson's view Ireland could not to-day supply the demand for winter butter if boracic acid were not used. Factory butter would suffer most if preservatives were prohibited. The question is one of the regulation of calving. There are some districts, he said, where it is certain that creameries will not oust factories.

IV. Messrs. Lonsdale and Co., Cork.—Here all cream from 30 auxiliaries is pasteurised under the direction of a Swede, who learned his dairying near Malmö. The oldest milk used is in summer that of the previous night, and in winter that of two days ago. If "fresh" cream—*i.e.*, cream under a certain degree of acidity—is not likely to be obtained from the milk the milk is sent back to the farmer. Cream from milk too sour will not make good butter after pasteurisation. Milk must be kept sweet. All milk is tested to ascertain its condition for pasteurising. Butter is sometimes made from milk that is a little sour, but the butter is of inferior quality. It is of the greatest importance that the cream used for pasteurising shall be perfectly fresh, the object of such pasteurisation being largely to enable the souring of the cream to be brought about by the use of artificial culture. If natural souring is allowed to take place prior to pasteurisation it is impossible to get rid of the sourness thus produced by the subsequent pasteurisation. No preservatives are used; none are considered necessary in pasteurised cream. The firm make the finest grade of butter with ½lb. of salt to 112lbs. Their assistants come from Lombardstown Creamery, where they received instruction at the hands of an experienced man.

In the act of pasteurising one of two methods is adopted. Either the whole milk is pasteurised at once, or the actual pasteurisation is confined to the cream, which is raised, and kept at, a temperature of 187° F. for at least five minutes. Butter thus made will keep for two to three months, with 3 per cent. of added salt, and with ½ per cent. of salt will keep two to three weeks. The best butter is only once worked, the salt being added at the time of working. Other butter with 3 per cent. of salt is partially worked one day, and completely the next. Hanson's lactic ferment is used for the preparation of the starters which are made from sterilised milk in the usual fashion; 12 gallons are added to 200 gallons, *i.e.*, 6 per cent. of the starter, which is made the day before use. There is 11·2-13·5 per cent. of water in the finished butter. The added salt is sprinkled on by hand. No colouring matter is used in creamery butter, but it is added to factory butter to suit local fancy. The firm have no detailed control over the auxiliaries; but, according to the regulations, no preservatives may be used by them.

The firm also have a butter factory. All butter received for blending must be unsalted on arrival at the factory. They use 0·75 lb. of preservative in each cwt. of factory butter. Salt and preservative are weighed separately before being added to the butter. No annatto is used, the colouration being produced by a solution of aniline colouring matter in cotton seed oil. The butter is kept in a cold chamber at 32-34° F. for periods varying from 2-5 months. Both preservatised and unpreservatised butter is stored, some with 3 and some with 1 per cent. of salt. There is found to be only a slight difference between butter sent out at once and cold stored butter.

V. Mr. Shanahan's Butter Factory, Cork.—Mr. Shanahan uses a preservative mixture of borax, boracic acid, saltpetre and glycerine; of which 0·75 per cent. is mixed with salt. He has a special butter worker invented by himself for turning the butter on the table. The conditions under which his factory butter is made are not known to him. He has issued no regulations as to farms. He has three classes of butter. He showed us a cold chamber at 37° F., and another at 36° F. He sends tinned butter to Africa, South America, various shipping companies, etc. It will keep for 12 months with 3½ per cent. of salt and 0·75 per cent. of preservative.

VI. Messrs. Cleeves' Creameries.—(1) Limerick.—All milk is heated to 110-120° F. before being separated. There are twelve separators. The separated milk is condensed. The cream passes over two coolers, one at 54° F., and one at 23° F.; and it is then kept in a cool chamber. There is no pasteurising in summer, but it is practised in winter. There is no handling of butter on the workers. A butter-milk starter is used. Only 1oz. of preservative and 1-3 lbs. of salt are used to each cwt. of butter. Salt is added up to 3 lbs. per cwt. according to the taste of the local market to which it is going. During the summer no preservative is used, nor on this account is the amount of salt increased. No complaints were received last year till September, when the preservative as above began to be used. The butter is salted at the first and only working, after the butter-milk has been expressed by a few revolutions of the table. The butter-milk is strained on leaving the churns. All separated milk is boiled for half an hour prior to being condensed at low pressure in a special apparatus, and no preservative other than sugar is used in the condensed milk. The firm have 24 receiving stations for milk for their five large creameries, the separation taking place at these collecting centres. All the milk is strained on arrival at the central creameries. While watching the process of straining, we saw among the *débris* from the milk, *inter alia*, a large slug and a milker's cloth.

(2.) Tipperary.—No preservative was added to the butter during the whole of last summer, until the second week in September, and no additional amount of salt was used. The butter is worked on the table before the addition of the salt and preservative. It is then twice washed in cold water. Only 3 ozs. of preservative are added to 6 cwts. of butter. All instructions come from the Limerick establishment. No complaints had been received last year until September, and then only a very few. The preservative and salt mixture is put in by the handful without weighing. There is no exact weighing of the ingredients. While we were present the dairymaid put 5½ lbs. of mixture on 200 lbs—approximate—of butter. The mixture was weighed for us, and was found to be 2 ozs. of preservative to 9¼ lbs. of salt; this being the proportion which the dairymaid had mixed, not knowing our intention to have it weighed. No ice is used, only cold water. The cream is set for 24 hours, all the year round, in a regulated temperature. There is a cooling chamber for setting cream, worked on the ammonia system. The firm have issued a strict order that evening milk is to be cooled on the farms. The creamery is working seven days a week.

We saw one of the cream collecting stations belonging to the firm, where the milk of 64 farms (1,200 gallons) is separated each day, and the cream sent in to the Tipperary establishment. The residue left on the strainer by 1,200 gallons was very small, suggesting that the farmers in this district strain the milk well. The milk is heated to 110° F. before being separated. The station was the first creamery set up in the district before its present restricted use. Its water supply is from four wells, which are said to furnish good water.

VII. Mayfield Dairy, Portlaw.—Two hundred and fifty farms send their milk twice a day in summer to this dairy. The total amount is about 4,000 gallons daily. The cans are washed by cold water and scalded by steam at the dairy One and a quarter lb. of preservative and 3 lbs. of salt (or none at all—to taste) are used to each cwt. of butter. The preservative does not vary in amount. The butter goes to Waterford by road—12 Enlish miles—and thence to Bristol by steamship.

VIII. Co-operative Creamery just started at Piltown.—The creamery had only started on the day of our visit. No butter had yet been made. Nine hundred £1 shares had been taken up; the initiative, we were told, lay with the parish priest, from whom, unfortunately, we failed to learn more of the facts; this we regret, as the information would have been of interest in view of the statements made to us by different traders that such local creameries could not be set going in the South of Ireland.

IX. Killeshandra Creamery, County Cavan.—Here ½lb. of preservative is used per cwt. of butter, and salt to taste. Milk is not pasteurised. It is heated to 100° F. before being separated. Milk is brought to the creamery direct from farms, and also from seven auxiliary creameries. There are 240 people sending direct to the creamery, and the number of farmers contributing amounts to 1,000.

X. Ballyhaise Creamery, Co. Cavan.—This was opened only in June; no preservatives had been used since August; further, the salt had not been increased since discontinuing the preservatives. Their motor power is water only, consisting of a very large water wheel, which gives never less than 50 horse-power. For heating milk and water a steam boiler is used. In future they will pasteurise cream as it comes from the auxiliaries. The water for cooling is pumped up from a well, yielding water at 53° F. in hot weather. They make their own ice, and have a large cold store chamber. There is a cement floor in all parts.

We saw some of the "skimming stations" where milk is separated and from which the cream is sent to the Cavan Creameries.

Crossdoney Skimming Station.—The cream is sent to Killeshandra. The station has double walls and roof, with empty air space, and a concrete floor. The receiving tank is heated from below, milk being raised to about 100° F., to facilitate separating. A pasteuriser will be put in this year at a cost of £50. On the day of our visit 738 gallons of milk had been separated. The separated milk is returned to farmers. The cream is cooled by a cold water cooler, and the vessels are cleaned by boiling and steam pressure. The station was set up in June, 1898. A sample of the milk is taken daily from each farm and examined weekly. It was one of the earliest stations set up in Ulster. Morning and evening milk is as a rule mixed.

Lossett Skimming Station.—This is a wooden erection with cement foundations and a corrugated iron roof. There is a hollow space in the walls and roof. Milk is separated at 150° F. The idea is in future to pasteurise whole milk before separation. There are two coolers. The cream goes to Killeshandra. The skimmed milk is sent back to farmers.

XI. Creamery near Waterford.—Here "Douglas' Food Preservative Antiseptic" is used, ½lb. to 112lbs. of butter. The firm were in the habit of using 2 per cent. before the Cardiff prosecution case. For seven or eight years butter was sent out with no preservative whatever, and no more salt than now. They add from 1lb. to 4lbs. of salt per cwt. of butter, according to taste. They stated that ½lb. of preservative plus 1½ lbs. of salt will keep butter for 10 days. The butter will then begin to "go off." The starter is made from butter-milk. The skimmed milk is taken by farmers. The farmers cleanse their own churns. The milk is weighed and strained on arrival and heated to about 90° F. in summer and 100-130° F. in winter before separating it. The cream is set in cold water tanks for 24 hours in summer. The temperature of the water used was 58° F. The cowsheds are used for milking all the year round. They have a cement floor, and were very clean and sanded with coarse gravel. They are also airy. There is sufficient space between the two rows of cows for a horse and cart to traverse the entire length of the cowshed, and the solid manure is collected in this manner. The liquid filth runs to one end by means of a sunk trench.

The Parcel Post custom of the firm is able to be kept up all the year round by means of regulating the calving of their own cows, 40 in summer and 40 in winter. The farmers in the neighbourhood cannot be induced to regulate the calving of their cows.

XII. Portable Creamery, Dunhill.—This structure will run from one station to another this year, separate the milk on the spot, leave the skim milk to go back to the farms, and the cream to go by cart to the central creamery. It is to be drawn by a traction engine of 5 horse-power through a very hilly country. The van has double walls and sides of wood, with corrugated iron covering. The inter-space is filled with silicated cotton. There is a concrete floor. The van was very hot inside, even with one end open, when we entered after it had been in use. There are a separator, a heater, tanks, etc., inside. The milk is strained on receipt, and cream and skim milk flow by different pipes to cans outside. The steam needed for the machinery will come from the traction engine.

MARGARINE.

We visited certain margarine factories in the course of our stay in Ireland. In every instance we were assured that preservatives, such as boracic acid were necessary in order to confer a keeping property upon the margarine. We were informed at one factory that on a certain occasion the preservative was accidentally omitted, and the whole consignment was shortly returned to the vendor, owing to the occurrence of decomposition.

BACON.

We spent some time in the larger bacon factories seen in the course of our visit, being accorded much information on the subject of the manufacture of that article. But we reproduce here only such facts as are pertinent to the object which we had in view, namely, the question of the use or non-use of preservatives other than salt or saltpetre in the processes of cure and packing.

At one factory at Limerick they use only salt and saltpetre, except during about two months in the year, when they sprinkle a little boracic acid on the outside in the folds of the skin, to keep the fly away.

The manager of another factory at Limerick thinks that salt and saltpetre do not suffice for modern bacon curing. He puts preservative in the brine which is injected into bacon. He dusts hams with boracic acid when they are to be hung. He does not think the finished article requires to be packed in boracic acid. This bacon goes to all parts of the world without any refrigerating chambers being deemed requisite on board ship.

At a factory at Waterford they cure whole sides of bacon. Hams are not cured. They inject a pickle into the meat, composed of a saturated solution of salt and water mixed with saltpetre. This saturated solution is mixed with the red pickle draining from the meat, the pickle forming five-sixths of the whole at some periods of the year. Bisulphite of lime is used in the very hot weather only. This is sprinkled on the fleshy part of the side, and brushed lightly over the whole length to prevent fly-blow, and is washed off within 24 hours. It is used in very weak solution. It is not considered necessary to use any preservative in the cure. The bacon goes to London, and is almost all used in the United Kingdom. It is mild cured bacon. It goes by steamer from Waterford, packed in a clean part of the hold, but not specially packed. For dusting over the thick portions, just as the bacon is being packed, the firm use three parts of salt to one of borax. It prevents fly-blow and moisture. The mixture is rubbed into the flank of the hog, immediately prior to packing, all through the summer, but not in winter. Twenty gallons of red pickle, plus 3 gallons of bisulphite of lime and 15lbs. of borax, are used during summer to fresh meat. This pickle is not used again.

At a factory a few miles from Waterford some preservative is used for bacon, in the injecting solution, which is composed of 8 gallons of water, 50lbs. of salt, some sugar, 8lbs. of saltpetre, and 4lbs. of boracic preservative. The bacon is dusted for curing with salt and saltpetre. There is a cold store for bacon at 52°F.

RAILWAY AND STEAMSHIP TRANSPORT.

Great Southern and Western Railway Company.

The Goods Traffic Manager, and the Assistant Superintendent of Traffic of this company, whose operations cover almost the entire district of the dairying industry of southern and western Ireland, were good enough to furnish us with the following information:—

Wagons fitted with ice receptacles are being built for the carriage of butter from Limerick and other places. It is not yet settled who is to supply the ice. The wagons are to be provided with double sides and roof, and the floor is to be lined with felt, and to have air space also. The ordinary wagons with double sides but no ice are used for butter transport. They have a special air space, but as a rule no special ventilation. Very little difference as regards temperature has, we were told, been found experimentally, whether the vans be painted white or no. Butter can be put into wagons at once on reaching the principal centre stations on the line, where the trucks stand until picked up by goods trains at night. Butter need not stand about the platform, but it may be in the trucks over twelve hours. Butter is generally sent by goods trains at night. It can be sent by passenger train at advanced freightage. The amount brought to Dublin was 2,213 tons from January to June, 1900, and 2,800 tons to Cork in the same period. During the summer season a special Saturday night butter train runs viâ Dublin, to Holyhead, in connection with the L. and N. W. R. Co.'s steamers on Sunday morning, for a special market held at Manchester on Tuesday. The butter arrives 24 hours in advance of the market, the consignees keeping it till Tuesday in cold storage. The butter is sent fresh, with or without any salt, and is largely creamery butter. A steamer also leaves Waterford in the same way on Sunday morning for Liverpool for the Manchester Tuesday market.

Milk is all carried by passenger trains. A large quantity comes up from Cork by night mail. Milk vans, ventilated at each end, are used for churns holding 18-20gals. each ; the vans are whitewashed inside early each season. Some farmers send milk in open trucks by preference. Limerick is a large centre for both milk and butter. Farmers only send milk once daily, the rule being to mix the morning and evening milk. The morning milk is often 24 hours old on delivery to houses.

Dublin is chiefly supplied with milk from local farms. The company carried only 433,690gals. in six months from January to June, 1900, for a population of 360,000 persons.

There is not much natural ice in Ireland. The transit of artificially-made ice from Dublin for storage by farmers would not be expensive. Farmers store but little ice now.

The company receive few complaints. Such as there are relate mainly to damage to butter on steamships.

We saw an ordinary milk van, which was whitewashed inside, and ventilated by upward slits across either end. Some butter wagons have double sides and roofs, no packing, two small ventilators, one on either side, and are whitewashed inside.

When at Mallow Station on September 18th last, we chanced to see a railway truck which was in use for milk and luggage. It had poor ventilation, and was foul smelling.

Midland Great Western Railway Company.

We saw Mr. Morrison of the traffic department, who told us that no special wagons have been built for milk or butter transport. There is no great traffic in these commodities. Butter is sent in dry wagons, and special instructions are given that the wagons must be in good condition when used for the carriage of dairy produce. The carriage of small family boxes is catered for at low charges in special boxes, as on many of our English railways. Butter goes by goods trains run at night. Milk is sent by passenger train. No complaints have been received as to either butter or milk.

We were given an introduction to the station master of Killeshandra, co. Cavan, from whom we learned that the night butter train takes 12 hours, 5 p.m. to 5 a.m., from Killeshandra to Dublin, 88 miles. It stops at Crossdoney Junction from 5.45 till 10 p.m. There are no special vans on the railway at present for this produce, and no provision is made for keeping fish, etc., from being placed in the same van as butter. Some 5-6 tons of butter are taken from the local creameries, and 2 tons from other sources, each week at Killeshandra Station. Straw or some dry material is put in the bottom of the vans. The same truck might carry butter one day and cattle another. The trucks used for cattle are whitewashed. The wagon would be very hot on a summer day before the butter was placed in it, having stood in the sun all day, unshaded.

Cork Steam Packet Company.

The officials of the managers' department informed us that the company have ten sailings a week—for Liverpool, New Milford, Bristol, Cardiff, Newport (Mon.), Plymouth, Southampton, and London. Their vessels are from 1,200 to 1,400 tons gross. The freightage for butter is 30s. per ton from Cork to London. Many complaints are received as regards butter sent by rail to inland places on arrival in England, but no complaints as to butter as landed at the port of arrival there. The butter is placed at once in a shed on being landed. Two of the steamers were fitted with refrigerating holds last year. They trade to Liverpool, and are highly appreciated. These vessels are 3-4 hours at sea before the cold chambers are reduced to a temperature of 40° F. The freights are not increased for these vessels. An increase of vessels fitted with such apparatus is contemplated. The managers are quite satisfied that such chambers form the best means of transporting butter by steamships. It is three days' steam to London, and the butter traffic is not large.

Some butter that is shipped at Cork comes there by railway, and much of it goes on to the butter market before shipment. No butter stands on the quays.

Boxes and packages have largely taken the place of firkins.

The butter is stowed in the lower hold of the vessels, below water-mark, but if sent in small quantities it might be packed among other articles. Any clean material, such as oats, might be placed with the butter. The temperature of the hold never exceeds that of the air outside. The management feel strongly that butter should not be shipped in a soft state. It should be placed in cold store first.

Cream is also carried, in large churns, to Southampton for inland places in ordinary vessels, and no complaints have come to hand as to its turning sour. It is kept on the upper deck in a cool place. The cream comes from country districts in Ireland.

CONCLUSION.

We do not propose, as we have already stated, to deal with the subject of dairying in Ireland in all its varied aspects. It will, however, we think, be abundantly evident from the facts which we have furnished in the foregoing report that the conception which the average Irish dairyman possesses as to the advantages to be derived from cleanliness, straining, and cooling is not so complete as is that possessed by the Dane. Hence the Irish milk and butter dealers are at a disadvantage as regards their ability to dispense with the use of preservatives. The facts adduced demonstrate the practicability of the manufacture in Ireland, and the ready sale in England, of butter free from preservatives. There is evidence also that forces are at work in Ireland tending towards a better state of affairs, *quâ* cleanliness, in which the use of preservatives is less likely to be thought essential than is the case at the present time.

As bearing upon this aspect of the question attention may be drawn to the fact, amply illustrated in the foregoing notes as to creameries and factories, that there has been a very decided tendency of late in Ireland to reduce the amount of preservatives used, while in certain instances the use of these substances has been entirely dispensed with. It is instructive, too, to note that when a reduction in the amount of preservatives has been made no increase in the percentage of salt added has been considered necessary.

It is, we think, desirable in the interests of Irish dairying that the farmers and dairymen of that country should grasp more fully the fact that the absence of cleanliness, cooling, and other necessary precautions conduces to the speedy decomposition of both milk and butter, and that rigid cleanliness alone, or cleanliness coupled with pasteurisation, is essential to counteract this tendency if the milk and butter are expected to remain fresh without the use of preservatives.

In connection, however, with the subject of pasteurisation, it might be well incidentally to point out the relation which pasteurisation bears to the use of preservatives.

A priori it might be assumed that the difference between them was merely one of degree, and concerning this, we made it our duty to elicit special information. From this it appeared that milk collected under dirty conditions, or which was for other reasons partially decomposed, cannot, even if subsequently pasteurised, be used for the production of the best butter. From this it follows that the success of pasteurisation as a method in the maintenance of high-class butter depends upon precedent dairy cleanliness.

Although the facts ascertained by us as a result of our inspection have gone far to convince us that there is no sufficient reason, in so far as the dairying industry is concerned, why preservatives should continue to be used in the preparation of Irish butter, we wish to express our opinion that any provision aimed at prohibiting the use of such preservatives should allow a sufficient interval to elapse before it is brought into active operation. We think that if such prohibition were operative forthwith a grave injustice might be done to a large number of persons. We would therefore suggest, that is if the use of preservatives is thought by the Committee to be undesirable, that a reasonable provision would be to prohibit the use of such preservatives in milk and butter from, say, October 30th, 1903. This would allow a considerable interval for the industry to adapt itself to the new condition of affairs; and we cannot refrain from the expression of opinion that such adaptation might be attended with no small benefit to the Irish dairying industry. It is not part of our functions to enumerate the several methods by which the necessary improvements may be brought about, but we may perhaps be allowed to put on record the fact that we heard much during our tour of inspection of the advisability of organising an adequate staff of specially Government inspectors who would be able to aid the dairymen by advice and assistance, and would also be possessed of powers sufficient to enable them to deal with offences against cleanliness.

We would repeat that there are already indications of no uncertain nature pointing to the conclusion that improvement is setting in, and we would add that a prospective prohibition of preservatives such as that of which we have spoken would be likely to facilitate in a material degree the better conception of cleanliness to which we have made reference.

H. Timbrell Bulstrode.
F. W. Tunnicliffe.
Chas. J. Huddart.

Addendum.

Leaflet of the Irish Agricultural Organisation Society. —Creamery Management.

Rules for Milk Suppliers.

The superiority of the creamery system over the old methods of butter making being now universally admitted, it is of the greatest importance that everything connected with the creamery and its products be perfectly clean.

In these days of keen competition from all quarters, it is only the very finest butter, of uniform quality, which can realise the best market price. The quality of the butter produced in the creamery mainly depends on the quality and condition of the milk from which it is made; therefore none but perfectly pure and sweet milk, free from any taint whatsoever, should be sent to the creamery. In butter making, nothing but the very finest quality can now be expected to pay dairy farmers, and, in order to produce butter of the best quality, the following simple, yet all-important rules, must be strictly observed:—

1.—Clean the Cows.

See that the cows' udders are thoroughly rubbed or brushed free from all dirt, and that the milker's hands are perfectly clean before milking. The filthy practice of dipping the fingers in the milk before milking must be discontinued. Groom the cow daily. If the hair about the udder is long, and not easily kept clean, it should be clipped.

2.—Clean the Vessels.

The milk pails and cans or churns must be scrupulously clean; first rinse them in warm water, then clean inside and out with a brush and hot water, using some soda if necessary, and afterwards scald them with boiling water and leave them exposed to the air, in a clean place. Use clean water. All milk utensils should be of metal, and have all joints smoothly soldered. Do not allow them to get rusty. Cans should have the separated milk emptied out of them as soon as they get back to the farm, and be cleaned. After cleaning, keep utensils uncovered, in pure air and sun if possible, until wanted for use. After delivering new milk, rinse and scald cans at factory steam jets before receiving separated milk.

3.—Clean the Cow-Houses.

The cow-houses must be kept perfectly clean, and free from injurious smells; they should be regularly swept, to prevent decaying matter from accumulating. Slaked lime should be frequently sprinkled on the floor, and brushed over it. Dairy cows, when stalled, should be kept in a building or room apart from other animals. The byre should be well ventilated, lighted, and drained; the floor should be paved, and the walls should be free from chinks or crevices. Never use musty or dirty litter. Do not allow any strong smelling materials in the byre for any length of time; remove the manure outside to as great a distance as practicable. whitewash the byre at least twice a year. Use no dry, dusty food just previous to milking; if fodder is dusty sprinkle it before it is fed. Clean and thoroughly air the byre at least an hour and a half before milking. Cows should always be milked in a perfectly clean place, where no bad odours can contaminate the milk, as it readily absorbs bad smells.

4.—Give Clean and Wholesome Food.

All feeding stuffs which impart their flavour to milk (such as turnips), should be given only after milking, to avoid tainting the milk as far as possible Where cabbage is fed to cows, all decayed leaves should be carefully removed. Cows should never be allowed to drink impure or stagnant water, but should have a plentiful supply of pure running water. Dirty water is not only injurious to milk, but also to the health of the cow herself. A lump of rock salt should also be provided for the cows to lick. Feed liberally, and use only fresh, palatable foods; under no circumstances should decomposed or mouldy fodder be given. Feed your cows generously in the winter, and the return they will give you in summer will astonish you.

5.—Attend to your Cows' Health and Comfort.

Remove from the herd at once any animal suspected of being in bad health, and reject her milk.

Do not urge cows faster than a comfortable walk when on their way to milking or feeding.

Do not allow the cows to be excited by dogs or hard driving, abuse, or unnecessary disturbance; do not leave them exposed to rain, cold, intense heat, or storms; under no circumstances allow cows to be struck with sticks or stones.

6.—Milking.

Milk quickly, quietly, cleanly, and thoroughly. Milk at the same hour every morning and evening.

Reject the first few strains from each teat; this milk is poor and of little value, and it may spoil the rest.

If any milk appears stringy, tinged with blood, or in any way unnatural, it should be rejected.

7.—How to Treat Dirt.

If by any accident a pail full or partly full of milk becomes dirty, do not try to remedy it by straining, but reject all the milk and rinse the pail thoroughly before using again.

8.—Do your Cows Pay for their Food?

Weigh and record the weight of the milk given by each cow, and take a sample, morning and evening, for testing once a week. Get the creamery manager to test these samples of each cow's milk for you. Some cows are heavy milkers and small butter producers, and *vice versâ*. A gallon of milk weighs ten and a third pounds.

9.—How to Treat the Milk.

The churn to receive the milk must be kept in a clean place, and all milk should be carefully strained into it through a fine strainer or clean muslin.

Stir and cool the milk as soon as strained, or get a small aërater and cooler combined. Cool as low as possible.

Never close a can containing warm milk which has not been aërated.

If a cover of the can is left off, a piece of muslin should be laid over it to keep out flies, dust, etc.

If milk is to be kept for any time the cans should be placed in fresh cold water in a clean, dry, and cold room, and should be stirred often enough to prevent a thick layer of cream forming.

Keep the night's milk under shelter to prevent the rain getting in. In warm weather put the cans in a tank of cold water.

Where possible, send milk twice daily to the creamery, and if this cannot be done, send the night's and morning's milk in separate churns. On no account should the hot morning's milk be mixed with the night's milk, but the night's should be cooled immediately after milking, and kept in a cool, clean place during the night.

No preservative should be added to prevent souring; cleanliness and cold are all that are needed.

When milk is carried a distance, the cans should be full, and carried in a spring cart.

In hot weather cover the cans with a clean, wet blanket.

10.—Prevention of Disease.

In the event of any outbreak of contagious or infectious disease in the household of the supplier, notice must be given at once to the creamery, and the supplying of milk discontinued until all danger of spreading disease through the milk is certified by a medical man to have passed.

11.—The Creamery Must Get Good Milk.

None but clean, fresh, and pure milk must be sent to the creamery. The milk from newly calved cows should not be sent for five days after calving, and on no account should the milk from ailing or diseased cows be sent to the creamery.

All milk is received at the creamery on the strict understanding that it is pure new milk, and subject to testing by analysis and other reliable methods of ascertaining butter fats, upon which basis it will be paid for alone, and the test of the society's analyst shall be final.

All possible sources of adulteration should be carefully watched by the supplier, so that all possibility of his employees skimming the milk may be avoided.

12.—What the Creamery Must Do.

Insist that all separated milk be heated up to 195° F. at least, and then cooled before delivery.

Insist on all pipes, tanks, etc., in the creamery being kept perfectly clean.

To obtain a pure supply at the creamery, it is absolutely essential that these simple rules be carefully carried out by every supplier, and it is only by so doing that the very finest butter can be made. One single can of tainted or the least injured milk is capable of contaminating and injuring the whole supply with which it comes in contact, and for this reason the creamery manager is obliged, in every such case, to refuse tainted milks.

Similar regulations to these are carefully observed by the farmers of other countries which are competing so keenly and successfully with us, so it becomes necessary that we must do the same, or yield to their competition. It is the interest and should be the duty of every milk supplier to a co-operative creamery, not only to send in pure milk himself, but also to see that his neighbours do likewise. There is no excuse for dirt in dairy farming. It can be so easily avoided, and it is such an expensive luxury.

Where any milk supplier is careless or criminal enough to neglect the observance of the foregoing rules, the whole force of the organised public opinion of the members of his society should be brought to bear upon him until he either mends his ways or is pointed to as the one hopelessly dirty member of the community.

NOTE.—This leaflet is one of a series issued by the Irish Agricultural Organisation Society, Limited, 22, Lincoln Place, Dublin, whose object is to promote combination among Irish farmers wherever and whenever the condition of their industry can be improved thereby. Full particulars on application to the secretary.

October, 1899.

APPENDIX NO. V.

Handed in by Professor Tunnicliffe.

REPORT UPON VISITS TO TWO PRESERVED VEGETABLE AND FRUIT FACTORIES, TOGETHER WITH CERTAIN EXPERIMENTS UPON THE EFFECT OF VARYING THE AMOUNT OF COPPER USED IN THE PRESERVING PROCESS UPON THE ULTIMATE GREENNESS OF THE PRESERVED PEAS.

I.—Visit to Factory A.

At this factory the following method of preserving peas is followed:—

The peas are boiled in large copper cauldrons, each cauldron dealing at one time with a bushel of peas, approximately 21·8 kilos. The cauldrons are kept perfectly clean, and immediately before a "boil" takes place 2lbs. of salt are placed in each cauldron, which is then filled with water approximately at the boil; the salt is dissolved, and in a few seconds the ensuing salt solution comes up to the boil in the cauldron; 28 grammes of copper sulphate are then added, and the boiling solution well stirred up till it is dissolved. A large copper cullender holding the bushel of peas is then lowered into the boiling copper sulphate and sodium chloride solution. The solution has free access to the peas in the cullender or basket, and these are from time to time stirred with a wooden spoon. The time during which the peas are allowed in this way to boil varies slightly, but the generally recognised time was two and a half minutes. The cook feels the peas from time to time, and determines by their relative softness or hardness whether they are done or not. If they are boiled too long they go brown, even when copper has been added; the older the pea the longer it requires boiling in the copper solution to maintain its green colour.

When the peas are done, the basket or cullender is lifted bodily out of the cauldron and placed in running water, by which means the peas contained in it are thoroughly washed.

The copper used in boiling the peas is weighed in a separate room by a female and made up into parcels, each parcel containing, accurately weighed by us, 28 grammes.

The peas after being washed in water are filled into tins or bottles, and syrup is added to them. The composition of the syrup is as follows:

Sugar - - - - -	25·4 kilos.
Salt - - - - - -	12·7 kilos.
Water - - - - -	1,600·0 litres.

The tins or bottles are then placed in an autoclave, where they remain about three-quarters of an hour.

Upon being questioned with regard to the quantity of copper necessary, the manager said the amount he used was a minimum. He had tried to use less, but the peas thus treated had always been returned to him as being off colour. He showed us some of these peas, which were certainly brownish. We further asked him whether the difference between peas with the full and a lesser amount of copper, resolved itself simply into one of time during which the green colour was maintained. He replied to this that it was not a matter of time at all, but was a question of fixing the colour entirely or only partially. The peas practically underwent no change in colour after they left the autoclave.

Through the kindness of the manager we were permitted to make the following experiments—

I.—Some peas were preserved without the addition of copper at all, but were otherwise treated exactly similarly to those preserved with copper. Two bottles of these peas were taken away by us, and kept for seven months, under ordinary conditions with regard to light and temperature. They were then opened, and after some had been taken out for analysis, were re-sterilised, and put up for inspection.

The characters of these peas may be described as follows:—

(a) Taste, good.

(b) Colour, greenish light brown.

(c) Analysis* showed the presence of copper to the extent of two milligrammes of metallic copper per kilo. These peas were not analysed in the fresh state, but as the amount of copper in them was in excess of that usually found in fresh peas, it was to be assumed that some of this copper was derived from the copper utensils used in the preserving process.

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* All the analyses refer to the simply strained peas. The liquor was on many occasions qualitatively, on some occasions quantitatively tested for copper.

II.—We preserved some peas in a manner exactly similar to that described above, except that we added 14 grammes of copper sulphate to 21·8 kilos, or just half the quantity generally used. Six months afterwards these peas were opened and treated as described under experiment I. The peas were pale green in colour, here and there brownish, and were found to contain 44 milligrammes of copper per kilo.

III.—In the third instance we preserved some peas exactly as they were usually preserved at this factory, viz., with 28 grammes of copper sulphate per 21·8 kilos of peas.

These last peas six months later were dark green in colour, and were found to contain 90 milligrammes of copper per kilo.

At the second factory we visited the method adopted was somewhat different. At this factory a "boil" of peas consisted of 140lbs. by weight. The peas were boiled in large copper vessels. The copper vessel was first filled with, approximately, three gallons of cold water, and then one ounce of sulphate of copper was added, when this had dissolved, the 140lbs of peas were added, the water then brought to the boil, and kept at the boil for from three to ten minutes, according to the size of the pea, the large peas requiring longer boiling than the small ones. After boiling, the peas were emptied out into a copper cullender, were well syringed with water, and were subsequently filled into bottles only. Syrup was added, consisting of a 1·5 per cent. solution of common salt. The bottles containing the peas were then placed in an autoclave, the stoppers being closed at about 80° C. They remained in the autoclave for about three hours.

The manager at this factory made the same reply to our inquiry concerning the relation between the amount of copper and the time for which the green colour was preserved as the manager of the first factory we visited.

Four grades of peas were used for preserving at this factory. Large, medium, small, and extra small, they are all the same pea, the difference being merely one of size. They are sorted by a machine mesh.

These manufacturers are quite persuaded of the necessity for copper if preserved green peas are to be supplied. They have tried various other green pigments, derived from chlorophyll, but have found none to succeed. They employed for some time a trained chemist. While he was with them he made some experiments upon the fate in the body of the copper ingested with the preserved peas. His results showed that the greater part of it was excreted with the fæces. He also made some estimations of copper in the copper sulphate solution before and after the peas had been boiled in it. His results showed that about half the copper was taken up by the peas, but this varied somewhat with the kind of peas, small peas taking up *ceteris paribus*, more copper, than large peas, weight for weight. The amount of copper taken up was also proportional to the time of boiling. The increased amount of copper taken up per unit weight by small peas as compared to large ones is probably due to the excess of surface offered by small peas per unit weight.

Through the kindness of the manager we were able to make the following experiments:—

I.—We first boiled 15·9 kilos (35lbs.) of the fresh morning's peas in three gallons of water for ten minutes. The peas thus boiled were put up into bottles in the usual way and sterilised in the autoclave. They were kept under ordinary conditions for six months, and were then examined. They were perfectly good, but their colour was greenish brown. Upon analysis they were found to contain 1·2 milligrammes of copper per kilo peas.

II.—We next boiled 15·9 kilos in exactly the same way, except that we added two grammes of copper to the water. The peas were subsequently treated exactly as described under No. 1, and at the end of six months were examined. Their taste was good, but their colour was practically identical with that of No. I. Upon analysis they were found to contain 18·7 milligrammes of copper pro kilo.

III. We next boiled 15·9 kilos. of peas in the same manner, adding 4 grammes of copper sulphate to the water.—The peas were subsequently treated in the usual manner, and after six months were examined. Their taste was good. Their colour was distinctly green, but was of a yellowish tinge. Upon analysis they were found to contain 38 milligrammes of copper pro kilo.

IV. Our fourth experiment in this connection consisted in boiling the same weight of peas as above in water containing 8 grammes of copper sulphate. These peas after sterilisation, etc., were kept for six months under ordinary conditions, and at the end of that time were found to have a good taste and to be of a full green colour. Upon analysis they were found to contain 74 milligrammes of copper pro kilo.

These experiments seem to show that the quantity of copper taken up by the peas is proportional to the strength of the copper sulphate solution in which they are boiled, when the time remains constant. Thus it would seem to be perfectly consistent, were any standard required, to use the amount of copper per unit weight of peas as such a standard, as this can be varied, at any rate within wide limits, by the preserver at will.

It seems further evident from these results, although they are few in number, and certainly should be amplified, that 50 milligrammes of metallic copper per kilo. is sufficient to ensure the permanency in preserved peas of a quite adequate greenness. Our experience in this regard is not in accord with that of many early observers, both German and French, who regard 0·018 copper pro kilo. as being sufficient to give a lasting green colour to the preserved peas. In our hands peas preserved with this quantity do not practically differ at all from purely natural peas. On the other hand, these experiments show that the quantity sanctioned at present by law in France and Italy—viz., 100 milligrammes pro kilo—is greatly in excess of that used, at any rate by English manufacturers. It may be that these discrepancies—absolutely small, but relatively great as they are—are due to the fact that we worked with different kinds of peas to those used for preserving in France, Italy, and Germany. The general statement that peas preserved with too much copper become bluish-green we should certainly confirm.

We thought it would be interesting in this connection to buy in the open market the following samples of preserved peas:—

V. A sample prepared in France for an English firm, and sold in this country.

These peas were bluish-green in colour, or perhaps to speak more correctly, after twice being sterilised, they possessed the colour of a dark green natural pea, if anything rather erring on the bluish-green side.

They contained 110 milligrammes of copper per kilo.

VI. A sample of peas bought in the open market in Nürnberg in Bavaria. The peas were prepared in Germany, and are similar in nature to those constantly used by the individual who bought the sample.

These are small peas, lightish green, but distinctly green in colour, and were found to contain 78 milligrammes of copper pro kilo.

VII. As there is a law prohibiting the use of copper in Germany, we thought it would be interesting to analyse another sample of German preserved peas. This last sample was prepared in Strasburg and bought in the open market in Germany. The colour of these peas was almost identical with that of sample V. By analysis they were found to contain 104 milligrammes of copper pro kilo.

The results obtained from the foreign samples are interesting in that they seem to point to the fact that considerable difficulty attends, if not actual legislation upon this subject, at least the effectual, or at any rate the successful, enforcement of it.

Appendix.

APPENDIX NO. VI.

EXPERIMENTS UPON THE EFFECT OF BORACIC ACID AND FORMALDEHYDE UPON THE LIVE WEIGHT, GROWTH, AND FOOD ASSIMILATION OF YOUNG SUCKING PIGS,

by

A. D. Hall, Esq., *Principal of the South Eastern Agricultural College, Wye,* and H. S. Hammond,

in collaboration with

Professor F. W. Tunnicliffe, M.D.

The experiments described below were undertaken to ascertain if small continual doses of food preservatives like boracic acid and formalin had any effect upon the live weight, growth, and food assimilation of young animals. Whatever may be the general effect of food preservatives upon health, it is obvious that the question is most critical in regard to children; not only is their diet largely or exclusively formed of milk, the article most generally treated with preservatives, but the digestion of the young is particularly liable to disturbances that often affect general health and growth. For the purposes of experiment young pigs were selected; an omnivorous feeder with a short digestive tract, the pig is more akin to man than is any other domestic animal; and what is more important, the young pig grows with extreme rapidity, and is very susceptible to adverse conditions, thus forming a reacting medium of considerable sensitiveness.

The method of experimenting was as follows:—A number of young pigs were kept under observation, and occasionally weighed until it could be seen that certain of them were growing steadily; several pairs of approximately equal weight and condition were then picked out and put on a uniform diet. When we were satisfied that they had settled down to the new conditions, one pig out of each pair received with his food the prescribed dose of boric acid or formalin, which at first bore about the same proportion to the food as exists in the preserved foods met with in commerce. The two sets of pigs receiving otherwise equal amounts of the same food, were kept under observation and weighed at regular intervals, the trials lasting until the pigs had very considerably increased in weight. The food used was meal, made from barley, oats, or wheat, made into a thin paste with water, to this the measured quantity of boric acid or formalin solution was added immediately before feeding.

I.—*Experiments with Boracic Acid.*

Four pairs of pigs, as closely matched as possible, were picked out, all being of the same breed, a Berkshire-Middle White cross. The pigs were about two months old when the observation began. Each pig occupied a separate pen, they were fed as nearly as possible to their maximum capacity, the amounts being adjusted from time to time, but the two pigs which were initially matched as a pair always received exactly the same amount of the same food. The food was varied a little during the trial, in addition to the meal each pig received daily a small quantity of green lucerne or vetches; the whole of the pigs throve under the treatment so much so that they were ready for market when the experiment ended. The pigs weighed from 30 to 40 lb. to begin with, and increased to from 70 to 90 lb. in the sixty-four days the experiment lasted. The daily ration was 2 to 4 lb. of meal per pig; the daily dose of boracic acid began at ·2 gramme, but was gradually increased to 2·4 grammes per pig, a concentration of approximately 1 in 800 of total food.

The actual results obtained are given in Table I. Figure I. shows the successive live weights expressed in curves, the continuous lines representing the weights of the pigs receiving boracic acid, the dotted lines those of the control pigs. The thickened vertical lines represent the dates on which the dose of boracic acid was increased.

It is clear that the differences between the individual curves in each pair are small, and probably within the limits of experimental error, and this is still more probable when the results are combined. In drawing up mean results we have thought it well to cast out No. 2. She was noticed to be "scouring" (diarrhœa) on July 12th, the day before the dose of boracic acid was increased, and though she recovered, the slight loss of weight that ensued was never made up. Casting out No. 2 involves casting out No. 6, the corresponding unit in the pair, so that we have to average the successive weights of 1, 3, 4, and of 5, 8, 7. The effect of this rejection of No. 2 and No. 6 is, however, barely appreciable in the final result. Figure II. is a smoothed growth curve, on which the average weight of 1, 3, 4, receiving boracic acid, are represented by X, and the average weights of 5, 8, 7, without boracic acid, by ⊙. It is obvious that the experimental error must be greater than the differences between the two lots, and that the doses of boracic acid have been without effect upon the rate of growth of the pigs which received them.

Examination of Fæces.

During the last twenty days of the experiment recorded above, the fæces of pigs 1 and 5 were systematically collected and preserved. Each pig was confined in a trough of tinned iron, arranged that the urine would readily run off with little or no contact with the fæces, which were collected twice a day. The fæces were to a certain extent contaminated with urine. Each day's fæces were weighed, mixed with 5 grammes of oxalic acid, and carefully dried; when approximately dry each sample was pounded up and well mixed with the fæces of the two following days to make a mixed sample (three-day unit). Six of these three-day samples were obtained from each pig—three when the daily dose of boracic acid was 1·2 gramme, and three after it had been doubled—the sample being rejected that was taken on the day of the change. It was originally intended to analyse the three-day samples separately, but by the time they were ready it had become clear that the boracic acid had been without effect on the live weight of the pigs, hence, to save labour, aliquots were taken from each, and mixed to form samples representing two nine-day periods, before and after the doubling of the dose.

During the twenty days in question the respective pigs received no green food. An aliquot portion of the meal they had each day was preserved so that at the end a mixed sample for analysis, representing the food of the whole period was obtained. The details are given in Tables II. and IIa. The general result is to show that the fæces contained about half as much fat as the food consumed during the period, the assimilation of fat being apparently more complete in the second than in the first period, as would be expected from the fact that the body weights of the pigs were increasing steadily without any sensible increase in their daily rations.

The difference in the amounts of fat in the fæces of Pigs 1 and 5—*i.e.*, in the control and experimental pig—is so small, that it is covered by errors of experiment, and from this it must be inferred that in this case boracic acid exerted no inhibitory influence upon the assimilation of fat. Less trust can be placed in the results as regards nitrogen, since we were unable to completely eliminate the error introduced by the partial admixture of urine with the fæces. Still there is a distinct agreement in the gross weight of nitrogen (which amounts to about a quarter of the nitrogen of the food) in the fæces of the two pigs. The proportion of fibre in the two lots of fæces is again in as close agreement as can be expected, taking in regard the possible experimental errors. The analytical figures obtained from the fæces and the fat content of the food relating to Pigs 1 and 5 are given in Table IIA.

It is interesting to note that each pig in the two periods plus the two days of interval increased in live weight by about 5 kilos; about 63 % of this increase in weight consists of fat (Lawes and Gilbert. Phil. Trans., 1859), and as only about 690 grammes of fat were consumed in the food and 290 were recovered in the fæces, each pig must have made about 2·75 kilos of fat out of carbohydrate and proteid during the period of experiment. The amount of digested proteid was only about 2·35 kilos, which, if we assume Henneberg's ratio, would yield 1·21 kilos of fat; we thus see what a potent fat-making machine a young pig is. Speaking generally, the analyses made of the fæces of the two pigs under experiment goes to confirm the results of the live weight determinations, and to establish the conclusion that boracic acid was without sensible influence upon the digestion of the young pigs receiving it.

II.—Experiments with Formalin.

The trials with formalin were conducted on the same lines as those described in the experiment with boracic acid. Six pigs were chosen and kept under observation till it was seen their rate of growth was steady, then the selected ones were matched in three pairs. The pigs in each pair always received equal weights of the same food, but one received a dose of formalin with every meal, suitably diluted, and mixed with the meal and water.

The formalin used was the ordinary commercial (Schering's) 40 per cent. solution of formic aldehyde, and the dose was 2 cc. formalin per pig per diem, increased later to 4 cc. per pig per diem (= 1·6 gramme formaldehyde). As regards the food, this amounted to a concentration of 1 in 730 (minimum with large pig), and 1 in 185 (maximum with small pig).

We were not able to match the pigs so closely in this as in the preceding experiment with boracic acid. Each of the three receiving formalin was a few pounds heavier than the corresponding member of the pair, with normal food, but the differences were not so great as to alter the character of the growth curves. The experiment lasted for seven weeks, during which time the weight of the pigs increased by about 60%, no difference was noted in the state of health of the two lots.

The successive weekly weighings are given in Table III., the food in Table IV.; Figure III. shows the individual growth curves; Figure IV. the mean growth curves, where the whole line epresents the successive mean weights of the pigs receiving formalin, and the dotted line the corresponding values for the pigs on normal food.

An examination of the curves shows that the growth of each pig was regular, and that there is no difference between the growth of those receiving formalin and those without, which would not be covered by the experimental error. During the last twenty days of the experiment the pigs 1 and 4 were confined in metal troughs, as described before; a daily collection of the fæces was made, and the fæces dried, but the negative results that had been obtained throughout made it seem unnecessary to proceed to a further examination of the material thus accumulated.

General Conclusions.

The experiments conducted with boracic acid showed a negative result attending the administration of this substance, and a combinative examination of the fæces of a boracised and normal pig showed no sensible difference in the amounts of fat, nitrogen, and fibre digested in the two cases.

Formalin gave similar results; the administration of formalin did not materially alter the rate of growth.

Our experiments would show that the digestion of young, rapidly growing pigs, as reflected in their general health and increase in live weight, is not sensibly affected by the regular administration over a long period, of doses of boracic acid and formalin in much larger proportions than they are usually employed for the preservation of food

TABLE I.

Giving live weights of boracised (1, 2, 3, 4), and control (5, 6, 7, 8) pigs.

Pen No.		June					July				August	
		5	12	19	26	30	6	13	20	27	3	7
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	bs.	lbs.	lbs.
1. Hog - - -	Boracic Acid.	44½	46	54¾	59½	61¼	66¼	70½	77¼	–	—	88¾
2. Sow - - -		31	33	41¾	46	47½	50¾	55¼	56½	62	65½	70
3. Hog - - -		27½	31½	38¼	43½	46	49	54¼	60¼	66	73	75¾
4. Sow - - -		35½	42½	50¾	54½	56½	61¼	66¼	73	78¾	83	87¼
5. Hog - - -	Controls.	44½	49	57¼	61½	64	69¼	75	83½	—	—	95¼
6. Sow - - -		30½	37	43¼	47	48	51½	55½	59¾	65¼	71	75¼
7. Hog - - -		35	40½	48	51¼	54¼	56¾	62½	68	74	79¼	84¼
8. Sow - - -		27½	32½	39¼	43¾	44¼	47	52½	57¾	62	68	72½

Appendix.

TABLE II.

RATIONS DURING THE BORACIC ACID TRIALS.

Pen No.	June				July				July-Aug.	Aug.
	5–12	13–19	20–26	27–30	1–6	7–13	14–20	21–27	28–3	4–7
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1. Hog - - -	18	28	27	14	21	24½	27¼	25¼	26¾	14
2. Sow - - -	15	21½	24¼	12	18	21	21	22¼	24½	14
3. Hog - - -	15	21½	24½	14	21	24½	27¼	28	28	16
4. Sow - - -	15	21½	24½	14	21	24½	27¼	28	28	16
5. Hog - - -	18	28	27	14	21	24½	27¼	25¼	26¾	14
6. Sow - - -	15	21½	24¼	12	18	21	21	22¼	24½	14
7. Hog - - -	15	21½	24½	14	21	24½	27¼	28	28	16
8. Sow - - -	15	21½	24½	14	21	24½	27¼	28	28	16

NOTES.

Boracic Acid Experiments.

Pigs Nos. 1, 2, 3, and 4 had boracic acid; Nos. 5, 6, 7, 8 had no boracic acid, but the same weight of food—viz., Nos. 1 and 5; 2 and 6; 3 and 8; 4 and 7.

Each pig had the same amount of green food per day, except during the period of fæces collection from Nos. 1 and 5, when these two had no green food.

Doses of Boracic Acid per Pig per diem.

June 6th to 9th - - - - - - ·1 gramme per meal = ·2 gramme per day.
„ 10th, 29th - - - - - - ·15 „ „ = ·3 „ „
„ 30th to July 13th - - - - - ·3 „ „ = ·6 „ „
July 14th to 27th - - - - - - ·6 „ „ = 1·2 „ „
„ 28th to August 7th - - - 1·2 „ „ = 2·4 grammes „

TABLE IIA.—BORACIC ACID. EXAMINATION OF FÆCES.

FIRST PERIOD OF NINE DAYS.

Boracic Acid dose = 1·2 gramme per diem to Pig 1.
None - - - - - - - - to Pig 5.

——	Pig 1.	Pig. 5.
Weight of Fæces (wet) - - - - - - - - - - -	7,252 grammes.	8,967 grammes.
Weight of Fæces (dry) - - - - - - - - - - -	2,331 „	2,552 „
Percentage of Crude Fat in dry Fæces (mean values) - - -	6·27	6·215
Percentage of Nitrogen in dry Fæces (mean valnes) - - - -	2·635	2·605
Percentage of Fibre in dry Fæces (mean values) - - - - -	22·62	20·94
Weight of Fat in Fæces - - - - - - - - - -	146·2 grammes.	158·6 grammes.
Weight of Nitrogen fn Fæces - - - - - - - - -	61·4 „	66·5 „
Weight of Fibre in Fæces - - - - - - - - - -	527·3 „	534·5 „

SECOND PERIOD OF NINE DAYS.

Boracic Acid dose = 2·4 grammes per diem to Pig 1.

——	Pig 1.	Pig 5.
Weight of Fæces (wet) - - - - - - - - - - -	7,832 grammes.	8,261 grammes.
Weight of Fæces (dry) - - - - - - - - - - -	2,547 „	2,530·5 „
Percentage of Crude Fat in dry Fæces (mean values) - - - -	5·00	5·05
Percentage of Nitrogen in dry Fæces (mean values) - - - -	2·84	2·755
Percentage of Fibre in dry Fæces (mean values) - - - - -	19·7	20·8
Weight of Fat in Fæces - - - - - - - - - -	128 grammes.	125 grammes.
Weight of Nitrogen in Fæces - - - - - - - - -	72·3 „	69·7 „
Weight of Fibre in Fæces - - - - - - -	501·3 „	526·2 „

Appendix.

The food in the first period amounted to 14,970 grammes; in the second period to 15,210 grammes.

—	% Composition.	Fed in First Period.	Fed in Second Period.
Fat	1·72	257 grammes.	261 grammes.
Nitrogen	1·86	279 „	283 „
Fibre	4·98	746 „	757 „

Table III.

Giving live weights of formalised (1, 2, 3), and control (4, 5, 6) pigs.

		July			August				
		13	20	27	3	10	17	24	31
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1. Sow	Formic Aldehyde	58½	61¼	66	69¾	74¾	—	—	95½
2. Sow		49	52½	55¾	60½	65¾	71	77¾	87¾
3. Hog		33¼	34	35½	37½	39¾	42½	45½	52
4. Sow	Controls	55¼	59	63½	68¼	73½	—	—	96¾
5. Sow		41¾	47	51	54¼	59	66	72½	78
6. Sow		24½	26¼	26¾	28¾	31	33½	34¾	39

Table IV.

Showing Rations During Formalin Observation.

Rations during the Formalin Trials.

—	July		July-Aug.	August			
	13–20	21–27	28–3	4–10	11–17	18–24	25–31
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1. Sow	21	21	21	22¼	26¾	28	28
2. Sow	21	21	21	22¼	26¾	28	28
3. Hog	11½	10½	10½	10½	10½	11¼	10½
4. Sow	21	21	21	22¼	26¾	28	28
5. Sow	21	21	21	22¼	26¾	28	28
6. Sow	11½	10½	10½	10½	10½	11¼	10½

Formalin Experiments.

Nos. 1, 2, 3 had formalin; Nos. 4, 5, 6, had no formalin, but the same weight of food—viz., Nos. 1 and 4, 2 and 5, 3 and 6.

Each pig had the same amount of green food per day, except during the period of fæces collection from Nos. 1 and 4, when these two had no green food.

Doses of Formic Aldehyde per Pig per diem.

July 13th to August 20th - - - - ·4 gramme per meal = ·8 gramme per day.
August 21st to 31st - - - - - ·8 „ „ „ = 1·6 „ „ „

Appendix.

Figure I.

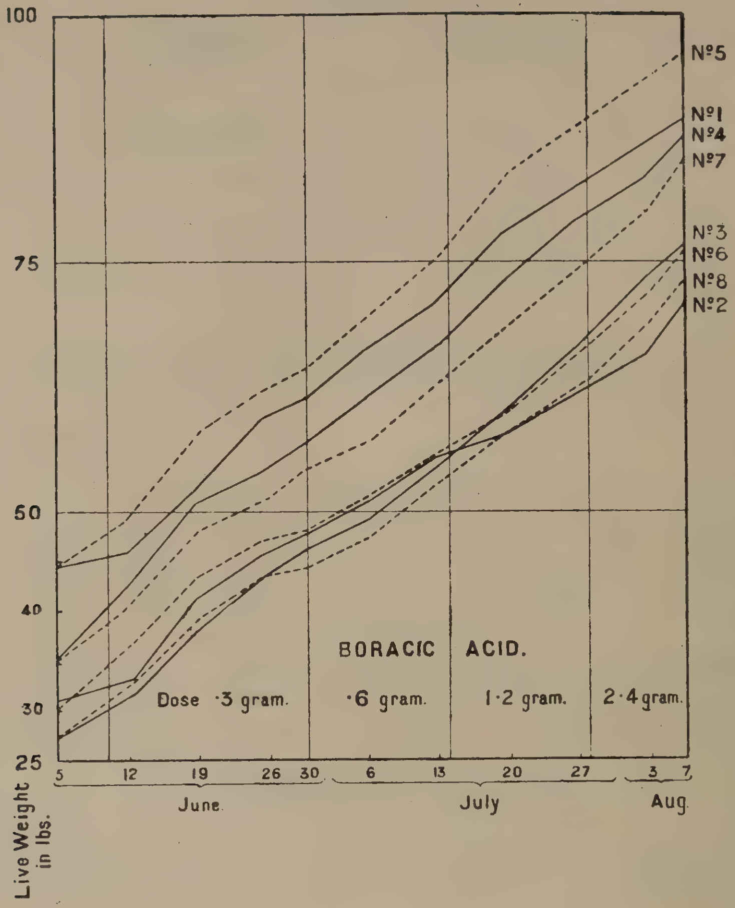


Figure II.

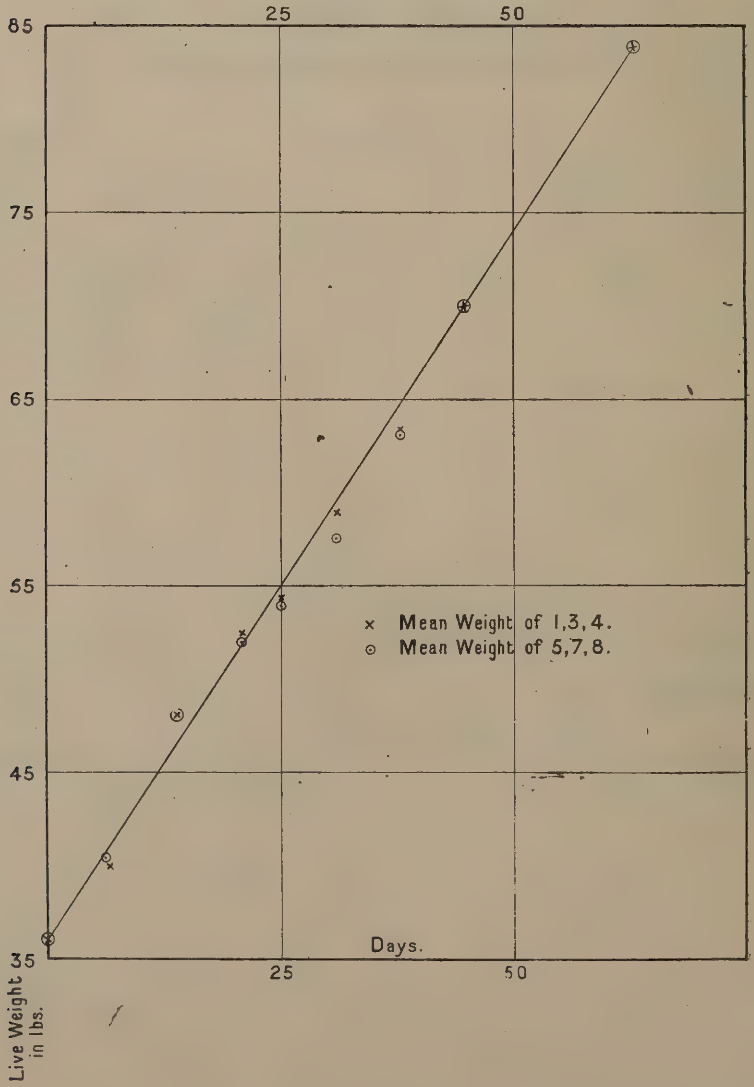


Figure IV.

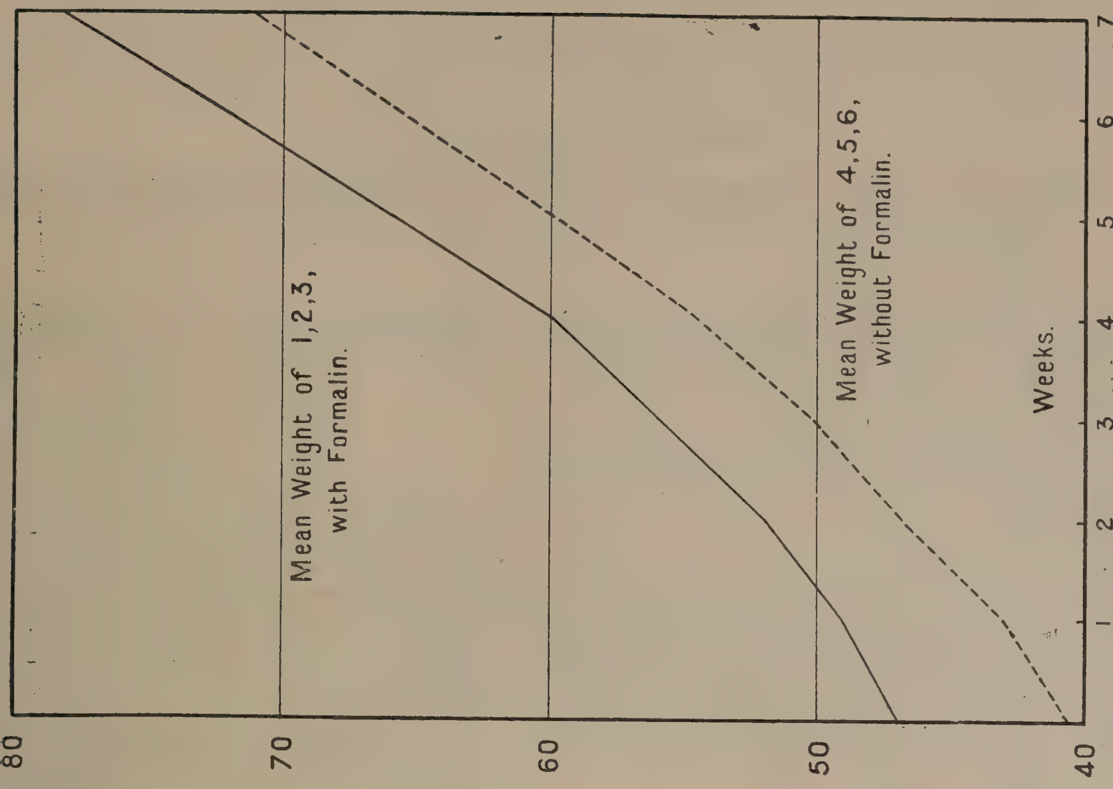
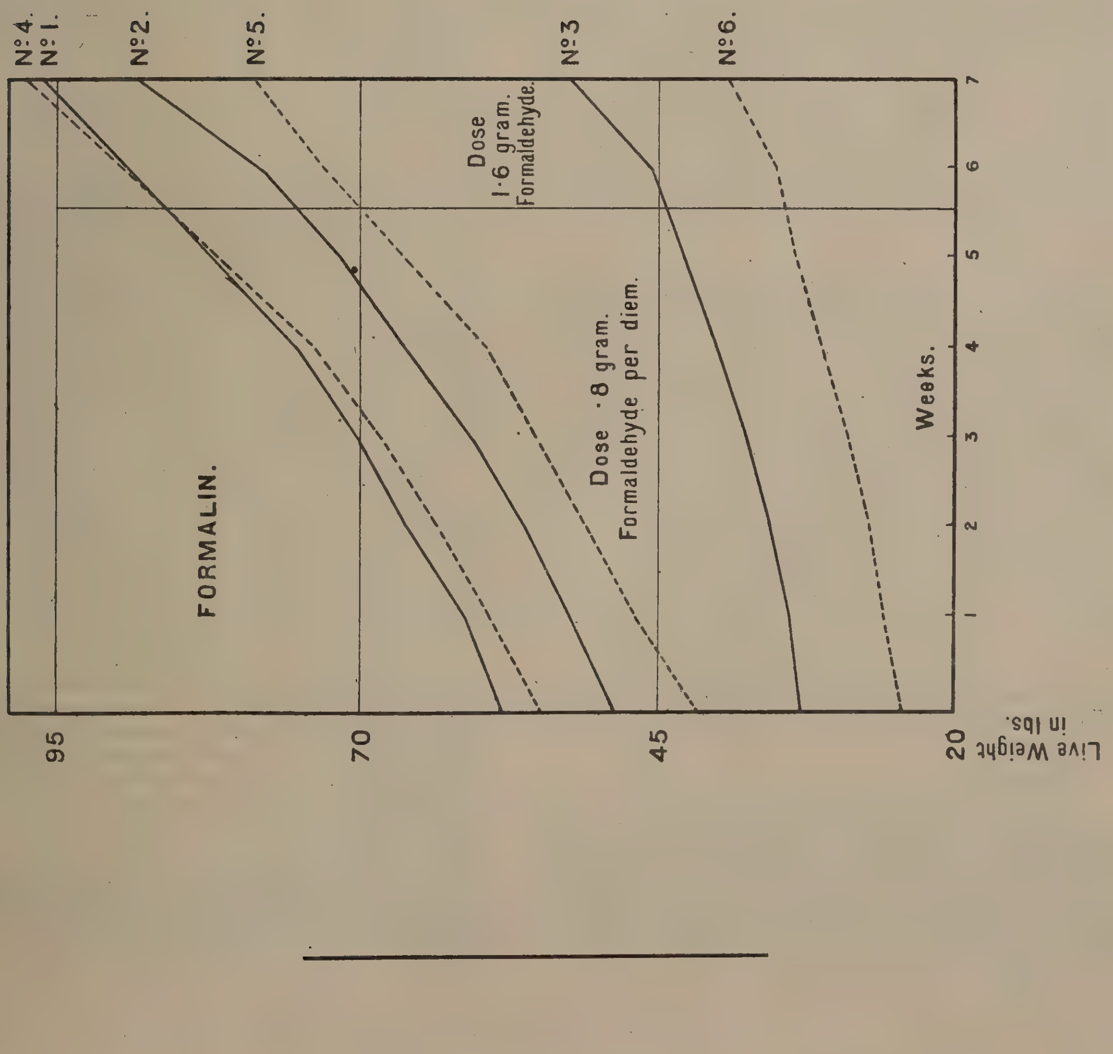


Figure III.



APPENDIX No. VII (*a*).

Handed in by Professor TUNNICLIFFE, being a

REPORT UPON CERTAIN EXPERIMENTS MADE UPON THE EXTENT TO WHICH THE COPPER INGESTED WITH ARTIFICIALLY-COPPERED PEAS IS ABSORBED AND RETAINED BY THE HUMAN BODY.

Appendix.

The method best calculated to elucidate this problem was to give to a child a known quantity of copper in preserved peas, the greenness of which had been fixed by means of copper on the commercial scale, and to estimate the copper in the excreta voided after their ingestion. Since, however, copper is normally present in our food and our excreta, it was necessary to give a uniform diet throughout the observation, and to estimate what may be termed the normal copper of the fæces.

As the absolute quantity of copper in the substances under consideration, viz., preserved peas, is very small, in order to obtain definite analytical results it was desirable for the child to eat as large a quantity of peas as she conveniently could at one meal. The peas were given instead of her ordinary mid-day meat. That they might replace this accurately from the dietetic standpoint, it was necessary for the amount of peas consumed to be such that their nitrogen was at least equal to that of the meat.

Following this method of reasoning, we fixed the quantity of peas to be ingested at 200 grammes, and this amount the child ate very willingly. As the change from a meat mid-day meal to an equal amount of nitrogen in the form of peas is perhaps somewhat acute, and might vitiate the results of the observation, we thought it advisable to control the results with commercially-coppered peas, by giving the child first the same weight of fresh peas. We did this to eliminate any influence of the peas, *quâ* peas, upon the intestine. This period, which we may term the "fresh pea period," lasting two days, and during which the child ingested 200 grammes of analysed fresh peas per diem, was followed by the "preserved pea period," in which an identical amount of commercially-preserved peas, previously analysed, was consumed.

Since, from the work of many observers, it is established that the copper in properly-preserved peas is present in the form of a phyllocyanate and albuminate, or in an insoluble and in what is known as a "masked" form, it was of interest to ascertain to what extent the absorption of this form of copper differed from that of copper in the form of an ordinary soluble salt. In order to decide this, we added a fourth period to our observation, in which the child took an equivalent quantity of copper, with fresh natural peas, the copper being added as sulphate to the peas after they were cooked and just before they were eaten. Subsequently to this, we allowed the child to return to its weighed and analysed normal diet, but continued for some time to estimate the copper in the urine and fæces; this period constituting the "after period."

We have thought it best to express the results of our observations in the following table, from which also the lengths of the respective periods may be seen*:—

TABLE showing the relation between the Ingestion and Excretion of Copper during the various periods (expressed in Mg. per diem.)

——	Mg. Cu excreted in		Total Excretion.	Total Ingestion with Peas.	Mg. Cu retained.	Per cent. of Cu exreted in Fæces.
	Fæces.	Urine.				
Fore period of eight days.	0·29	–	0·29	–	–	–
Fresh pea period of two days.	0·72	Trace.	0·72	0·35	–	–
Preserved pea period of two days.	10·79	0·03	10·82	14·00	3·18	77%
Freshly coppered pea period of two days.	7·45	0 03	7·48	22·06	14·59	34%
1. After period of eight days.	1·42	0·06	1·48	–	–	–
2. After period of four days.	0·57	0·08	0·65	–	–	–
3. After period of six days.	0·35	–	–	–	–	–

From this table it will be seen that directly after the ingestion of the coppered peas, the amount of copper voided by the fæces underwent a very marked increase. If during the whole of the coppered pea period we subtract the amount of copper in the fæces from that taken by the mouth with the peas, we shall find that 77 per cent. of the copper so taken was at once voided. This copper can, for all practical purposes, be regarded as never having entered the blood. The absolute quantity of the copper remaining is small. It is probably stored up in the liver and excreted slowly with the urine and fæces.*

In striking contrast to the rapid elimination of copper when taken in the form of "phyllocyanate" is the behaviour of the ordinary soluble salts, for instance the sulphate, when they are ingested with the food. In our observation we probably had to some extent a mixed result, in that the copper of the sulphate, since the latter was well mixed with the peas, after they had been cooked in butter, entered, at any rate in part, into combination with oleic acid and the organic substances in the peas, so that what was actually ingested was oleate of copper, some organic copper compound, and copper sulphate. It will be seen from the table that although a much larger quantity of copper was administered in this case, only a much smaller quantity of it was directly voided with the fæces. If we subtract the quantity of copper present in the fæces from the quantity ingested, we arrive at the result that only 33 per cent. of the copper administered in this way was immediately excreted, and from this it follows that 67 per cent. was retained in the body. There is distinct evidence, as will also be seen from the table, that this copper is slowly excreted by the urine and fæces, more especially by the former, since, at the end of our observation, although the copper in the fæces was approximately normal, the amount excreted by the urine was still continuing to rise.

GENERAL CONCLUSION.—From our research, we regard the conclusion justified that copper, when ingested in the form in which it occurs in carefully-preserved peas, is for the most part voided directly with the fæces, and differs, in so far as concerns its absorption and retention by the human body, from the ordinary salts of copper.

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*The fæces belonging to the respective periods were divided from each other by the administration *per os* of charcoal, the copper estimations were made by means of the colorimetric ferricyanide method. For further technical details the reader is referred to a more exhaustive article upon this subject shortly to be published.

*The copper, however, thus excreted with the fæces must be distinguished from the copper excreted with the fæces directly after ingestion, for whereas the latter never entered the blood, the former was excreted from the blood by the mucous membrane of the intestine.

APPENDIX No. VII. (*b*).

REPORT ON THE INFLUENCE OF FORMIC ALDEHYDE UPON THE METABOLISM OF CHILDREN; HANDED IN BY PROFESSOR TUNNICLIFFE, BEING A SERIES OF OBSERVATIONS MADE BY HIM IN COLLABORATION WITH DR. OTTO ROSENHEIM.

Formic Aldehyde, the simplest possible aldehyde, is a substance possessed of considerable biological and chemical interest. Its biological interest consists in the fact that it has long been regarded as forming the first product of plant assimilation, and has recently been actually demonstrated as such in plants.[1] The ease with which this substance undergoes polymerisation under the influence of simple reagents resulting in the formation of sugars, justifies the assumption that formic aldehyde is an essential link in the building up of complex carbohydrates by plants. In addition to this it has recently been requisitioned as the only possible source of proteid anabolism.[2] Its interest to the physiological chemist is that it combines energetically with proteids and to a less extent with carbohydrates, effecting considerable alteration of their physical and physiological properties. This behaviour seems to be directly antagonistic to the biological *rôle* ascribed to the substance above. This apparent anomaly of the same substance being both a poison and an essential physiological constituent of living cells is discussed by Loew.[3] It seems to depend upon the fact that what may be termed the biological formic aldehyde is present in small quantities (dilute solutions) and is quickly used up, owing to the ease with which it polymerises or forms innocuous compounds. This last property has an immediate bearing upon the subject of this inquiry in so far as it may serve to explain the results obtained by the administration of small quantities of formic aldehyde to man in his food. It is in this connection that formic aldehyde is of interest to us, and the importance of this subject is, in our opinion, sufficient to justify us in reviewing somewhat exhaustively the results of other observers with regard to the chemical and physiological properties of this substance.

Hofmann[4] discovered formic aldehyde (CH_2O) in 1869. It is a gas, soluble in water, and obtainable commercially as a 40 % solution which is known as formaline or formol. It has an irritating and pungent odour, and is easily converted into a polymeric solid modification. Its disinfectant action was first pointed out by Loew,[5] and has subsequently engaged the attention of numerous workers, amongst whom may be mentioned Trillat, Aronson, Blum, &c. Their results are mostly of interest to bacteriologists, and are outside the subject of our inquiry. The literature, so far as it concerns us, may be classified as follows:—(i.) Chemical action of formic aldehyde upon proteids; (ii.) Influence of formic aldehyde upon digestions *in vitro*; (iii.) Experiments upon animals.

Chemical Action of Formic Aldehyde upon Proteids.

The action of formic aldehyde upon native proteids is in general to render them insoluble. Egg and serum albumen are, however, exceptions. The compounds which formic aldehyde forms with them are soluble and non-coagulable by heat.* The reaction between formic aldehyde and the proteids is explained by assuming an interaction between the aldehyde and the amido groups of the proteid molecule. There is, however, no proof of this. The insoluble compounds are resistant to the action of the digestive enzymes.†. By the action of steam the formic aldehyde is easily split off, the proteids re-formed possessing their original digestibility. (Blum[6], Bach[7], Riche[12], Benedicenti[8], Beckmann[9], Mosso and Paoletti[10], Foulerton[11].)

According to Lepinois[13], a 1 % solution of formic aldehyde preserves thyroid glands without affecting either their digestibility or the solubility of the active principle—iodo-thyrin.

The evidence concerning the action of formic aldehyde upon albumoses and peptones is somewhat conflicting.‡ According to Beckmann[14], gelatine peptone and egg albumin peptone are unaffected by formic aldehyde, whereas hemialbumose is rendered insoluble. Trillat, without giving any experimental data, makes the statement that formic aldehyde renders insoluble all proteid substances not coagulable by heat. This generalisation would, of course, include albumoses and peptones.[15] Lepierre[16] worked on the action of formic aldehyde upon the products of partial peptic digestion isolated by himself—viz., hetero, proto, and deutero albumoses and peptones; also upon commercial peptones, the composition of which he previously examined in the usual manner. According to him there was no action in the cold, and even at 100° C., working with a 14 % formic aldehyde solution, only in some cases did precipitation take place; mostly (commercial peptones) no change occurred. From subsequent examination of the resulting solutions, concerning which no details are given, enunciates a theory according to which formic aldehyde causes a progressive regression of the simpler products of proteid digestion back again to the more complicated ones—viz., of peptones to deutero-albumoses, of deutero-albumoses back to proto-albumoses, which finally are precipitated. This observer states further that the compounds formed by formic aldehyde and the proteids are digestible, but less rapidly than the corresponding original proteid, and that these compounds could be reconverted into the original easily digestible proteids by the action of super-heated steam.

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[1] Pollaci, Boll. chim. farmac., 1899. xxxviii., p. 1601.

[2] Loew, Die chemische Energie d. lebenden Zellen, pp. 67, 86, &c., and R. Hebert Ann. Argronom., xcviii., p. 416.

[3] Loc. cit., p. 66.

[4] Berichte d deutsch. chem. Ges., 1869, p. 152.

[5] Loew, München. med. Wochenschr., 1888, p. 412.

[6] Zeitschr. f. physiol. Chemie, 1896, p. 137.

[7] Moniteur Scientifique, 11, p. 157.

[8] Du Bois-Reymond's Archiv., 1897, p. 210.

[9] Forschungs-Berichte uber Lebensmittel-Unters. etc., iii., p. 324.

[10] Gior. d. r. Accad. di med. di Torino, 1895.

[11] Lancet, ii., 1899, p. 1579.

[12] Journ. Pharm. Chim., vi., p. 197.

[13] Bull. Soc. Chim., 1899, t. ix., p. 76.

[14] Loc. cit.

[15] Bull. Soc. Chim., 1898, p. 1017.

[16] Compt. rend. Acad. de Sc. Paris, t. cxxviii., p 789.

[17] Bull. Soc. Chim. 1899, t. ix., p. 76.

* In this regard it may be mentioned that Trillat (Compt. rend. Acad. d. Sc. Paris, 1892, t. cxiv., p 1279) states that formic aldehyde coagulates albumin as well as blood. Subsequently, Blum (Zeitschr. f. physiol. Chemie, 1896, p. 137) found that formic aldehyde prevents the coagulation by heat of serum and egg albumin in aqueous solution, a fact which has been confirmed by Benedicenti and all later observers.

† Hehner (Analyst, xxii., 1897) said, in a discussion on formic aldehyde, that he had seen the results of certain experiments, which showed that the soluble compound formed by formic aldehyde and egg albumen was digested more easily than egg albumen itself.

‡ Loew (loc. cit.) observed that pure peptone gave no precipitate with formic aldehyde, whilst commercial peptones (Witte) yielded immediately a precipitate in the cold. This he regards as being due to the presence of albumoses propeptones).

Influence of Formic Aldehyde upon Digestion in Vitro.

The work done in this connection may be divided into that which concerns itself with the action of the digestive enzymes in the presence of formaldehyde, with their action upon formalised food, and with the effect of formic aldehyde upon the enzymes themselves. The digestions can be considered in this regard *seriatim.*

Salivary Digestion.—Rideal and Foulerton[1] estimated the amount of maltose formed from arrow-root starch by saliva alone and in the presence of formic aldehyde in different proportions. Taking the control as 100, they found that ptyaline in the presence of 1 in 100,000 formic aldehyde converted 99·8%, in the presence of 1 in 10,000 89·00%. Foulerton[2] tested the progress of starch conversion in the presence of formic aldehyde, and found that dilute solutions, 1 in 40,000 to 1 in 1,000, had a retarding but not an inhibitory action.

The relative convertibility of previously formalised starch into sugar by means of ptyaline has, so far as we are aware, only been investigated by Bliss and Novy.[3] These observers found that a 1% starch paste, previously kept for five days at 35° C. with formic aldheyde (1 in 100), behaved with ptyaline exactly as fresh starch paste.

The same investigators showed that formic aldehyde, in the strength of 1 in 1,000, exerts very little action upon ptyaline itself, unless the mixture is allowed to stand for several days, or is kept at 35°–40° C. With stronger solutions of formic aldehyde the effect is more marked, the ferment being destroyed by the action of 1 in 1,000 for nine days at 40° C.

Rennet.—Pottevin[4] observed that formic aldehyde added to milk retarded its coagulation by rennet, and that rennet itself (loc. cit.) was rendered inactive by strong solutions of formic aldehyde.

Bliss and Novy also examined the action of rennet upon formalised milk, and found that milk which had been subjected to the action of formic aldehyde, 1 in 1,500, behaved in this respect very similarly to normal milk (normal milk coagulated in 15 minutes, this formalised milk in 20 minutes). Milk which had been acted upon by formic aldehyde, 1 in 1,500 for 1 hour, behaved identically with normal milk.

Foulerton's[5] experiments with rennet show that formic aldehyde added to milk in the proportion of 1 : 40,000, whether at the same time as the enzyme or 48 hours before, has practically no influence upon the process of coagulation. With higher proportions up to 1 in 5,000 coagulation was retarded, but not prevented. This was also the case to a more marked degree with solutions of 1 in 1,000. These results with higher proportions do not correspond with those of Bliss and Novy detailed above. The discrepancy in the results of these two observers is probably to be explained by the variations in milks and rennets used. It will be noted that the behaviour of the control milks was not identical (coagulation in 15 mins. Bliss and Novy, and 30 mins. Foulerton).

Halliburton[6] observed that strong solutions of formic aldehyde delayed rennet action, more dilute solutions acted similarly but to a less marked degree. Freudenreich[7] observed that formic aldehyde in the form of vapour had a destructive influence upon rennet, but that in solution in the strength of 1 in 500 it had no appreciable action upon its milk coagulating power.

With regard to the action of formic aldehyde upon the rennet ferment itself Bliss and Novy[8] found that it had no apparent effect upon this ferment, even when present in the proportion of 1 in 50.

Peptic Digestion.—Symons[9] found that formic aldehyde did not influence peptic digestion.

According to Mayberry and Goldsmith[10], when pepsine was allowed to act upon fibrin in the presence of formic aldehyde the amount of fibrin digested diminished with the increasing percentage of formic aldehyde. Taking the control as 100, they found that, when formic aldehyde was present in the proportion of 1 : 2,000, 97·74 % of the fibrin was digested, when present in the proportion 1 : 1,000 94·34 %.[11]

Rideal and Foulerton[12] concluded from carefully executed quantitative experiments that the addition of formic aldehyde immediately before digestion in the proportion of 1 : 50,000 had no appreciable effect. Their quantitative results were as follows:—When formic aldehyde was added in the proportion of 1 : 50,000 immediately before digestion, the amount digested in unit time was 97·63 %, taking the control as 100.

With regard to *previously formalised* proteid they found that (taking again the control as 100) 91·45 % was digested in the case of fresh beefsteak previously formalised for twenty-four hours with 1 : 100,000, 90·38 % when the strength was 1 : 50,000, 85·25 % when formic aldehyde was increased to 1 : 10,000. From these results they conclude that formic aldehyde has no influence on the digestibility of the food after contact with it for twenty-four hours prior to the action of the enzyme.

These conclusions have been criticised by Hehner[13], and in a subsequent paper Foulerton[14] modifies them considerably, and infers that in addition to any possible effect which formic aldehyde may have on the action of the enzyme, it also renders food itself less digestible.

Bliss and Novy[15] found that the digestion of fibrin by pepsin, both previously formalised for twenty-four hours proceeded normally when the strength of formic aldehyde was 1 : 2,500, and even when it was increased to 1 : 100 the fibrin was eventually digested.

Halliburton[16] made a series of experiments on the relative digestibility of fibrin previously treated with formic aldehyde (for from two to three days with 1 : 100 to 1 : 2,000). He found that previous formalisation with 1 : 2,000 for two days delayed gastric digestion twenty minutes, for three days for thirty minutes. Formalisation with a 1 % solution did not prevent digestion, the latter becoming complete in twenty-four hours.

Loew[17] was the first to study the action of *formic aldehyde on pepsin* and found that when this enzyme was exposed to strong solutions for one day it lost its activity.

Bliss and Novy[18] subsequently found that pepsin is not affected by a 1 % solution of formic aldehyde, even when the mixture has stood for four weeks. Even a 5 % solution acting for three weeks has no effect on pepsin. Contrary results by others are explained as being due to an alteration of the fibrin by the aldehyde, before the pepsin could act.

Pancreatic Digestion.—Symons[19] found that when formic aldehyde was added to the digestive mixture in the proportion of 1 : 2,000, it had a distinctly retarding influence on pancreatic proteolysis (fibrin), whilst 1 : 300 completely inhibited digestion.

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[1] Public Health, 1899, p. 554.

[2] Lancet, 1899, ii., p 1432.

[3] Journ of Experimental Med., 1899, iv., p. 74.

[4] Ann. de l'Inst. Pasteur, 1897, p. 807.

[5] Lancet, 1899, II., p. 1578.

[6] Halliburton. Brit. Med. Journ., 1900, ii., p. 2.

[7] Freudenreich, Centralbl., f. Bakteriologie, Abth. ii., 1898, p. 309.

[8] Loc. cit.

[9] Journ. of American Chem. Soc., 1897, xix., p. 744.

[10] Journ. of American Chem Soc., 1897, xix., p. 889.

[11] The results of Mayberry and Goldsmith were re-calculated by us, from the average of their experiments (taking average of the three control experiments as 100.

[12] Public Health, 1899, p. 554.

[13] Brit. Food. Journ., 1899, p. 132.

[14] Foulerton, Lancet, 1899, pp. 1432 and 1577

[15] Loc. cit.

[16] Brit. Med. Journ , 1900, ii., p. 2.

[17] Loc. cit.

[18] Loc. cit.

[19] Loc. cit.

Rideal and Foulerton's[1] results showed that when formic aldehyde was added in the proportion of 1 : 50,000 to milk immediately before its artificial digestion with commercial pancreatin 97·0 % of casein were digested, taking the amount digested in the control experiment as 100.

With regard to *previously formalised* milk the same authors found that 94·1 % casein was digested when milk formalised to the extent of 1 : 50,000 was acted upon by commercial pancreatin (taking as before the amount digested in the control as 100).

Bliss and Novy, working with commercial pancreatin and fibrin, found that fibrin previously formalised for twenty-four hours with 1 in 1,000 formic aldehyde was digested much more slowly than fresh fibrin, but that its total digestion did eventually take place. The same observers, working with *fresh pancreatic extract*, found that when fibrin was formalised for twenty-four hours with 1 in 1,000 there was no influence upon its digestibility, whilst when 1 in 500 was used there was a slight retarding influence.

Halliburton[2] studied the effect of previous formalisation upon the digestibility of fibrin by means of commercial pancreatin, and found that whereas the digestion of fresh fibrin was completed in thirty minutes, that of fibrin, previously formalised by an exposure to formic aldehyde solution, 1 in 2,000, for two days, required ninety-five minutes for its completion. In the case of formalisation with stronger solutions no signs of digestion occurred within twenty-four hours.

Loew[3] observed that when a *solution of trypsin* was treated with formic aldehyde a precipitate occurred. The action of formic aldehyde upon the pancreatic enzyme has been carefully studied by Bliss and Novy.[4] They found in the case of commercial pancreatin (Parke Davis) that solutions of formic aldehyde in the strength of from 1 in 1,000 to 1 in 100, acting for twenty-four hours, completely destroyed its proteolytic activity. In the case of freshly-prepared pancreatic extract the influence was not so marked; a strong extract, previously formalised for twenty-four hours with 1 in 1,000, digested formalised fibrin (1 in 1,000) normally. When the ferment solution was previously formalised with 1 in 500 there was a distinct retardation in the case of the *strong extract, and absolute destruction of proteolytic power* in the case of the weak extract.

Amylolytic Ferment of Pancreas.—Rideal and Foulerton[5] tested the activity of the amylolytic ferment of two samples of commercial pancreatine in the presence of formic aldehyde. They found that when formic aldehyde was added immediately before digestion, so that it was present in the digestive mixture in the proportion of 1 in 50,000; 91·8 % maltose was produced in the case of Extract No. I., and 84·00 % in the case of Extract No. II. When the formic aldehyde was present in the proportion of 1 in 10,000, 91·5 % and 83·0 % maltose were produced respectively. The amount produced under normal conditions was taken as 100.

Halliburton[7] made a few experiments with regard to starch conversion by means of commercial Liq. Pancreaticus (Benger) in the presence of formic aldehyde, and found that the strongest solution of formic aldehyde caused a retardation of total conversion amounting to five minutes, the weakest a retardation amounting to two minutes. Bliss and Novy[8] made some observations upon the amylolytic power of previously formalised, freshly prepared pancreatic extracts. From their results it follows that formic aldehyde has very little influence upon them. Amylopsin, previously formalised for twenty-four hours with 1 in 1,000, was not affected; even 1 in 500 exerted but little action. Lipase seems unaffected by formic aldehyde (Kastle and Loewenhart Am. Chem. Journal xxiv. No. 6).

Experiments upon Animals.

The symptoms produced by formic aldehyde consist in strong local irritation. The animals become restless, and exhibit clonic convulsions and opisthotonus. They finally pass into a condition of coma, during which the respiration is quick and irregular in rhythm, the cause of death being asphyxia. According to Benedicenti[9], formic aldehyde is a blood poison, converting hæmoglobin into hæmatin.

The toxicity of formic aldehyde upon higher animals seems to be relatively low, and differs considerably according to the animal.

Trillat[10] gives the lethal dose per kg. body weight for guinea pigs as 0·8 g. when injected *sub cutem*, whilst 0·53 and 0·66 produced no effect: 0·038 g. per kg. guinea-pig injected into a vein was also without result.

Berlioz and Trillat[11] found the toxic dose for dogs (intravenous) to be 0·07 g. pro kg., and for rabbits (intravenous) 0·09 g. pro kg.

Aronson[12] found 0·24 g. per kg. body weight to be lethal for rabbits, and according to Pottevin[13] larger doses than 0·25 g. pro kg. *sub cutem* and 0·03 g. per kg. intravenous are lethal for the same animal. 0·016 g. injected into the veins of rabbits for four days in succession produced no effect.

According to Mosso and Paoletti,[14] 0·32 g. pro kg. proved lethal for dogs, while 0·22 g. produced serious symptoms.

Bruni[15] found that 0·28 g. pro kg. killed a dog, to which the same dose had been administered *per os* the day before.

When *administered by the mouth* the results obtained are somewhat conflicting.

Blum[16] gave to a rabbit weighing 1,500 g., 0·72 g. formic aldehyde in two doses, in the form of a 1 : 2 % and of 2 : 4 % solution. The animal refused food for a day. He also administered 1·5 cc. of a 40 % formalin solution—that is, 0·6 g. formic aldehyde—to a hare. The hare took its food normally after two days.

U. Mosso and Paoletti[17] gave to a dog 0·04 g. formic aldehyde in the form of a 1 in 250 solution. Vomiting ensued. Subsequently they gave 0·022 g. formic aldehyde in the form of a 1 : 500 solution. No vomiting occurred, but symptoms referable to an action of the drug upon the central nervous system. A dose of 0·011 g. in the same dilution produced no effect.

Bruni[18] found that 0·032 g. of a 1 : 1,000 solution had no effect upon a dog weighing 7·2 kg., and that 0·28 g. formic aldehyde in the form of 1 : 500 solution caused vomiting in a dog weighing 14 kgs. After fifty minutes no further disturbances occurred.

Some experiments have been made with regard to the general effect of doses of formic aldehyde continued for some time upon animals.

Rideal and Foulerton[19] fed cats three months old for a period of several weeks on milk containing formic aldehyde to the extent of 1 in 50,000, 1 in 25,000, and 1 in 20,000, and in two cases noted an increase in weight, while in one case the weight remained constant. They further fed one rabbit in the same way, estimating the amount of nitrogen in the food and the excretions, and found that the animal gained in weight, and that although there was some increase in the excretion of nitrogen, the nitrogen balance remained positive. These observers, however, give no control experiments. Reviewing these experiments in a later article[1] Foulterton concludes that these observations were not sufficiently numerous to allow of any stress being laid upon them either one way or the other

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[1] Brit. Med. Journ., 1900, ii., p. 2.

[2] Loc. cit., p. 2.

[3] Loc. cit.

[4] Loc. cit.

[5] Loc. cit.

[6] Loc. cit.

[7] Loc. cit.

[8] Loc. cit.

[9] Arch. f. (Anat.) Phys., 1897, p. 210.

[10] Loc. cit.

[11] Compt. rend., 1892, t. cxv., p. 291.

[12] Berliner klin. Wochenschr., 1892, p. 751.

[13] Ann. de l'Inst. Pasteur, 1894, p. 807.

[14] Giorn. d. r. Accad. di Med. di Torino, 1895.

[15] Ann. di Farmacoterapia e Chimica, 1899, p. 339.

[16] Münchener med. Wochenschr., 1893, p. 602.

[17] Loc. cit.

[18] Loc. cit. pp. 338 *et seq.*

[19] Loc. cit.

Annett published some experiments[2] on young kittens three or four weeks old extending over several weeks. These he fed on milk containing formic aldehyde 1 in 50,000, 1 in 25,000, and 1 in 12,500. Control experiments were made on a smaller number of kittens fed on normal milk. The quantity of milk taken by each kitten is not given, therefore no data are available with regard to the quantity of formic aldehyde consumed by each kitten. These experiments and the conclusions drawn from them have been criticised at length by Liebreich[3] and Rideal,[4] who have pointed out that the results were so irregular* in comparison to the number of animals experimented upon, that no important conclusions could be drawn from them.

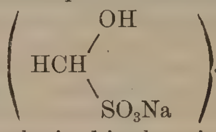
Rideal further pointed out that cows' milk as such is an unsuitable food for kittens of that age, and that six kittens fed on undiluted fresh cows' milk all died. Rideal in the same paper published a series of observations upon kittens five weeks old fed with 70 cc. of cows' milk per diem formalised to the extent of 1 in 5,000 he noticed under these conditions no injurious action but an increase in body weight.

In this connection some experiments have been made by A. D Hall and H. S. Hammond in collaboration with ourselves at the South Eastern Agriculture College, Wye. These observations will be published fully elsewhere; they showed that the continuous administration for six weeks of from ·8 to 1·6 grammes daily of formic aldehyde with a mixed diet had no effect upon the live weight of young sucking pigs. The initial weight of the pigs varied from 25 to 58 lbs., and the quantity of formic aldehyde given amounted to a concentration of from 1 in 185 to 1 in 730 total food.

Concerning *the fate of formic aldehyde* in the animal body, the results of various observers are not in accord.

Trillat (loc. cit.) found that the guinea-pigs' urine underwent no fermentative change after they had been injected with formic aldehyde. According to Aronson (loc. cit.) the urine of rabbits after the administration of large doses of formic aldehyde has a reducing action upon ammoniacal silver nitrate, and gives Schiff's reaction for aldehydes. Blum (loc. cit.) could not find formic aldehyde in the urine of rabbits after doses of 0·6 g., but obtained traces of formic acid.

Quite recently Filippi and Martoleni[5] have studied the fate of formic aldehyde in the body after injection. The object of the research seemed to be to determine whether the results of Albertoni[6] concerning acetic aldehyde—namely, its complete excretion as such without oxidation—were true for formic aldehyde. They seem unaware of the fact that these results have not been confirmed by Reizhenstein.[7] They quote Perando[8] as having found that formic aldehyde is completely oxidised in the body to formic acid, and call into question his methods. From their own experiments they conclude that formic aldehyde, after its administration in apparently very large doses, could be found in all the organs of the body, the colour reaction upon which they relied being most marked in the intestines, lungs, and kidneys. No mention is made as to its presence in the urine.

Among the compounds of formic aldehyde easily discomposable into the original substance, Pohl[9] has examined the fate in the body of the sodium sulphite compound  $\left(\mathrm{HCH}\begin{matrix}\diagup \mathrm{OH}\\ \diagdown \mathrm{SO_3Na}\end{matrix}\right)$. After the administration of 5 g. of this substance to a dog, no aldehyde reaction could be obtained in the urine, but there was a very slight increase in the amount of formic acid normally present. The fate of the ammonium compound of formic aldehyde (Hexamethylentetramine or urotropin) is discussed by Nicolaier[10] in his original communication. His results have subsequently been confirmed by other observers. Urotropin appears rapidly in neutral or alkaline urines as such, and in acid urines as formic aldehyde.

With regard to *the fate of formic aldehyde* in the body, the observations of Pohl (loc. cit.) are of interest. He found that the fresh organs of warm-blooded animals, especially the liver, can oxidize formic aldehyde to formic acid. Jacobi[11] isolated a pure ferment from the liver of oxen, possessing very strongly the power of oxidizing aldehydes, especially salicylic aldehyde.

Action on Man.—Very little is known concerning the action of formic aldehyde on man, either in therapeutic or poisonous doses. A case of poisoning is recorded by Andès[12] in which a "spoonful" of a 40 % formic aldehyde solution was taken by mistake. Ammonium acetate and an emetic were administered immediately, and complete recovery took place in two days. No general symptoms other than those referable to shock were recorded.

Another case is mentioned in the Medical Press[13], where a youth took about 2·5 grammes of formic aldehyde in the form of a 4 % solution. Vomiting occurred, and death twenty-nine hours afterwards from heart failure. A post mortem examination showed "that the œsophagus was slightly inflamed, and escharotic changes were visible in the stomach."

Trillat[14] gave 5 grammes of the polymerised solid modification of formic aldehyde to patients, without any poisonous symptoms. Aronson records similar experiences with paraform aldehyde.

The ammonia compound (urotropin) mentioned above is used extensively in medicine.

Quite recently[15] 50 cc. of a 1 in 2,000 solution of formic aldehyde has been injected intravenously as a means of treatment in pulmonary tuberculosis without any symptoms of poisoning occurring. The injections were continued over a considerable time.

Critical Review of Literature.

In this connection we do not purpose considering formic aldehyde from either a therapeutical, bacteriological or toxicological standpoint, but from the standpoint of its possible use as a food-preservative. This limitation of our point of view brings us at once to a limitation of material and quantity. Material in so far as we have only to consider milk, and quantity in so far as only those experiments are relevant in which formic aldehyde is used in quantities not in excess of those necessary for its action as a preservative. In this regard the strong solutions are at once excluded owing to their taste, and because they are unnecessary.†

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[1] Lancet, 1899, ii., p. 1582.

[2] Lancet, 1899, ii., p. 1284.

[3] Liebreich, Lancet, 1900, i., p. 13.

[4] Rideal, Lancet, 1900, i., p. 228.

[5] Ann. Farmacoterapia e Chimica, 1900, p. 195.

[6] Albertoni e Lussana, Padua, 1875. Albertoni, Arch. Italiennes de Biologie, 1888.

[7] Dissertation Würzburg, 1894.

[8] Perando. Boll. di R. Acc. med. di Genova, vol. xi., no. 9.

[9] Arch. f. exper. Path. u. Farm. 1893, p. 281.

[10] Centralbl. f. med. Wiss, 1894, p. 897, and Deutsche Med. Wochenschr., 1895, p. 541.

[11] Zeitschr. f. physiol. Chemie, 1900, p 133.

[12] Journ. de Pharm. et Chim., 1899, t. x., p. 10.

[13] Medical Press, 1899, p. 309.

[14] Journ. de Pharm. et Chim., 1894, p. 540.

[15] Reported in Brit. Med. Journ. from Dr. Maguire's Harveian Lectures, Nov. 24th, 1900.

* *E.g.*, he obtained three deaths in the case of the 1 in 50,000 milk, none with the 1 in 55,000, and two with the 1 in 12,500.

† By the assistance of a number of observers we were able to convince ourselves that formic aldehyde in the strength of 1 in 2,000 imparted to milk in the cold a characteristic taste. If the milk were warmed to drinking temperature 1 in 5,000 could be easily detected.

From a careful consideration of the results of various workers we are inclined to accept 1 in 25,000[1] as the maximum quantity which can possibly come in regard in this connection; but, as it will be seen from the context, we took for the purpose of our own experiments a higher proportion (1 in 10,000 and 1 in 5,000).

If we consider the literature, keeping these limitations in mind, the following points are to be emphasised :—

From the experiments made to ascertain the chemical action of formic aldehyde upon the proteids generally, the conclusion may be drawn that compounds of a more or less definite composition are formed, and that the digestibility of these compounds is less than that of the original proteids. All these experiments, however, relate to compounds produced by the action of an excess of formic aldehyde, none being recorded with dilution approximating to that of the above adopted standard. Taking in regard the complex nature of milk and the excess of chemical compounds capable of combining with formic aldehyde in it, in proportion to the very small amount of formic aldehyde added, it does not seem to be justifiable to draw *a priori* conclusions as to the effect of formic aldehyde upon the digestibility of the proteid constituents of milk, from the mere chemical data above.

With regard to the chemical reactions between formic aldehyde and the products of partial or complete proteid digestion, we must bear in mind again that so far as we know these reactions only take place at unphysiological temperatures, and with relatively concentrated solutions of formic aldehyde.*

If we direct our attention to the digestion experiments *in vitro* with formic aldehyde, we come to the conclusion that, speaking generally, under the conditions of these experiments, formic aldehyde has a retarding effect upon the digestion of food by the various enzymes concerned. In the case of peptic digestion, this effect is less marked (according to some observers there is no effect) than in the case of pancreatic. The general value of these conclusions is, however, in our opinion, somewhat lessened by the following considerations. All experiments have been made with commercial pepsin or trypsin, except the later pancreatic digestions of Bliss and Novy, from which it is manifest that the difference between the digestibility of formalised and fresh proteid is far less marked in the case of fresh trypsin, than in that of commercial. These observers found that, in the case of freshly prepared pancreatic juice, fibrin formalised with 1 in 1,000 formic aldehyde, was as digestible as fresh fibrin. Since we have no experimetal data with regard to fresh pepsin, we cannot tell to what extent the activity of this latter might have been affected by formic aldehyde.

No digestion *in vitro* following physiological sequence has been carried out, in no case has the residue of the gastric digestion of a formalised food been subjected to pancreatic digestion. No quantitative experiments, as far as we are aware have been made concerning the most important point under consideration, viz., the gastric digestion of formalised milk.

It has been pointed out by many critics[2] that conclusions from experiments *in vitro* can only be applied, if at all, to living animals with great caution, since the conditions which obtain in the living stomach are much more complicated, and impossible to imitate *in vitro*. To mention one of the more gross objections, we may point out that no attempt is made in digestions *in vitro* to imitate even the mechanical conditions which obtain in the living stomach, which effect both a continuous churning of the food with the digestive juice, and a continuous removal of the products formed. Further, from the purely biological standpoint, according to the interesting experiments of Pawlow,[3] the food seems, by virtue of its relative digestibility, to have an influence upon the nature of the secretion produced by the stomach to digest it. In addition, a possible stimulant action on the part of formaldehyde must not be overlooked, so far as concerns the secretion of the enzymes and their quality, apart from a possible stimulant action upon their activity. That formic aldehyde seems to have a stimulating action upon certain enzymes may be concluded from the experiments of Macfadyen, Morris, and Roland[4] on Buchner's Zymase, and from those of Weigle and Merkel[5] upon diastase, and from those of Kastle and Loewenhart upon "Lipase."

With regard to the experiments on animals, only those interest us in which the formic aldehyde was given by the mouth. Even in these the formic aldehyde was in no case given with food, but in a free state in water; and when any effect was produced at all, the drug was present in a concentration and in an amount far in excess of that in which it would be given as a preservative in food. So far as concerns the effect of formic aldehyde when given to animals admixed with food for long periods, the results are conflicting, but, on the whole, seem to show that formic aldehyde in moderate doses has little or no influence upon the growth, weight, and general health of even young animals.

It will be seen from the above criticism that, although we are provided with a copious indirect literature, no conclusions, in the absence of direct observations upon man, can be drawn concerning the possible effect upon him of the addition of small doses of formic aldehyde to his food. It was clear to us that the only way to fill this gap in the literature was to make such observations, and the kind of observation best calculated to give exact and definite data for conclusions was, in our opinion, a series of metabolic experiments.

General Arrangement and Method of Experiments.

Before entering into the details especially relevant to our own observations, it might be well to recapitulate briefly the general principles of metabolic experiments. They consist in the exact estimation of the quantity of food and its various constituents during a given period, and the estimation during the same period of the total excreta and their constituents, chiefly with regard to nitrogen, phosphorus, fat, &c. By this means we get valuable information with regard to the assimilation of these substances by, and their retention in the body. We should like to point out, however, that there is a slight fallacy in this reasoning, in that our knowledge of the origin of fæcal nitrogen is somewhat limited. According to Praussnitz[6], the whole of the nitrogen in the fæces arises, not from the unabsorbed nitrogen of the food, but from intestinal secretion (epithelial cells, &c.). The value of the metabolic method is not to any extent affected by this, in so far as all nitrogen excreted by the fæces must be regarded as lost to the body, and its subtraction from the quantity of nitrogen ingested gives us the quantity of nitrogen retained. It must, however, be observed at once, as has been emphasised by Pawlow[7], that the results of these experiments give us no absolute information with regard to the actual digestibility of any given food, in so far as we are left by them in complete ignorance of the amount of energy spent by the organism in producing the observed effect. Providing the organism is equal to the occasion, an indigestible food might be as well assimilated and retained as a digestible one; but to produce this result an additional output of energy would be required. If this additional output of energy were relatively small we should probably have no indications with regard to it, but were it relatively large, or, in other words, were the difference in the digestibility of the foods in question great, we should probably find that the body weight, or the general health of the person under observation, would be affected, and this effect would be the more noticeable the longer the period of observation, and the more sensitive the person chosen.

On general principles we thought it advisable to allow our observations to extend over comparatively long periods, and to take what were *a priori* to be regarded as relatively sensitive re-agents—viz., children, both robust and delicate, and to observe minutely during the various periods their general health and behaviour. From

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[1] *Vide* Droop Richmond and Harrison. Analyst, 1900, p. 116. It is further interesting in this connection to observe, assuming Benedicenti's figures to be correct (loc. cit., p. 243), that milk could fix owing to its 3 % of casein in 0 0036 % formic aldehyde, whilst 1 in 25,000 formic aldehyde corresponds to 0·004 %. There seems to be a relation between the fixing of the formic aldehyde by the casein and its power as a preservative as the time during which this amount will keep milk sweet corresponds approximately to the time required for the proteid to fix all the formic aldehyde.

[2] Rubner. Leyden's Handb. der Ernährungs Therapie, bd. i., p. 114. Hammarsten Lehrb. der Physiol. Chemie, 1895, p. 247, &c.

[3] Pawlow, Die Arbeit der Verdauungsdrüsen, 1898.

[4] Berichte der deutsch. chem. Gesellsch. 1900, p. 2782.

[5] Forschungsberichte über Lebensmitteln, etc., 1895, p. 91.

[6] Praussnitz, Zeitschr. f. Biologie, 1897, p. 287.

[7] Loc. cit.

* Lepierre loc. cit. Compare also Schwarz loc. cit.

Appendix.

another standpoint children had in this connection an additional interest, on account of the fact that milk forms so large a proportion of their diet, and it is to milk that formic aldehyde as a preservative is generally added.

Our observations were made upon three children, two of whom (boys) might be regarded as typically healthy, and were aged 2½ and 5 years, the third child, girl, aged 4 years, was delicate, being convalescent from pneumonia. We shall refer to the children subsequently as A., B. and C respectively. During the whole period the children were under our perpetual observation, and absolute control was kept over all ingesta which were accurately weighed by us, and excreta which were collected in diurnal periods without loss. The general conditions of their life remained constant, they were kept for some time before the "fore period" of the observation began under identical conditions to those obtaining during the observation. They took each day the same amount of exercise, and their habits were in every respect regular. The research was carried out during the months of April and May, and extended in the case of A. and B. over a period of four weeks, in the case of C. over one of three weeks. Each period was subdivided into three—a fore, a middle or formic aldehyde period, and an after period. The relative lengths of these periods will be seen from the tables. The children had a mixed diet. With regard to the quantities of the different food-stuffs, we were guided at first by the work of Camerer[1]. This was subsequently modified to a small extent by our own observations concerning the establishment of nitrogenous equilibrium in which the children were approximately placed before the fore period began. Every article of food was carefully analysed with regard to its percentage composition, and in no case were so called average figures taken.

In order to minimise the amount of analytical work entailed by this method, the three children were supplied from the same stock of foods, which were taken originally in as large a quantity as was consistent with their keeping properties. To this end Pasteurised milk was supplied to us in bottles, each lot of bottles being taken from the same churn[2]. Each lot of meat lasted for about four days; lean beef was usually taken, and the whole stock minced; a sample of this was then analysed.

The following table shows the percentage composition of the foods used :—

TABLE I.—Showing the percentage Composition of Foods.

—	Specific Gravity.	Water %	Fat %	Total % Carbohydrates.	Nitrogen %	Phosphoric Acid %	Ash %
				Lactose.			
Milk I.	1·0329	86·55	4·50	4·92	0·49	0·29	0·69
" II.	1·0331	86·92	3·85	4·03	0·58	0·28	0·70
" III.	1·0320	87·36	3·50	5·21	0·49	0·24	0·69
" IV.	1·0329	87·76	3·37	4·81	0·51	0·23	0·64
				Dextrose.			
Bread I.	—	36·10	0·51	47·47	1·48	0·36	—
" II.	—	40·13	0·11	39·21	1·50	0·18	—
" III.	—	35·77	0·24	55·48	1·32	0·19	—
" IV.	—	29·83	0·23	59·13	1·78	0·27	0·89
" V.	—	34·42	0·11	60·80	1·55	0·19	0·89
				Lactose.			
Butter I.	—	12·46	86·44	0·36	0·02	—	0·65
" II.	—	12·82	85·44	0·21	0·13	—	0·72
" III.	—	12·89	85·31	0·40	0·12	—	0·61
" IV.	—	12·68	86·00	0·14	0·11	—	0·50
Meat - I.	—	75·00	5·38	—	2·95	0·41	—
" Veal II.	—	74·13	0·78	—	3·79	0·55	—
" - III.	—	72·12	6·31	—	3·08	0·51	—
" - IV.	—	72·60	6·67	—	3·23	0·53	1·00
" - V.	—	69·04	7·12	—	3·52	0·46	1·07
" - VI.	—	74·48	4·62	—	3·74	0·46	1·00
				Dextrose.			
Apple - I.	—	70·08	—	25·20	0·04	0·04	0·35
" Compote II.	—	56·66	—	37·66	0·05	0·05	0·38
" " III.	—	69·86	—	30·25	0·05	0·04	0·33
				Dextrose.			
Toffee	—	1·06	2·20	18·24	0·03	—	—

The excreta were collected without loss, in twenty-four-hour periods from 8 a.m. to 8 a.m. and worked up the same day. The fæces were weighed in their normal state each day, small quantities of acid added when necessary, and subsequently evaporated on a water-bath. When dry they were finely powdered, weighed, and analysed. The fæces belonging to each period were separated by means of the administration of powdered charcoal.

Methods of Analysis.—All nitrogen estimations were made by Gunning's[3] modification of Kjeldahl's method. It was found advantageous, especially in the analysis of the fæces, to add a few crystals of copper sulphate to the mixture of sulphuric acid and potassium sulphate, as by this means a very rapid and quiet oxidation was obtained. Two methods of *phosphorus* estimation were used. In food, fæces, and urine the total phosphorus was estimated by Neumann-Keller's method,[4] viz., by oxidation in a Kjeldahl's flask by means of nitric acid and ammonium nitrate, subsequent precipitation with molybdic solution, &c., and weighing as magnesium pyrophosphate. For the estimation of lecithin phosphorus in the ethereal extract of the fæces, the usual process was used (oxidation by means of a mixture of sodium, carbonate and nitrate, and subsequent estimation of phosphorus as before). *The carbohydrates* were estimated gravimetrically as dextrose or lactose, by means of Fehling's solution. *The fats*, which term includes all the ether soluble substances, were estimated by extraction in Soxhlet's apparatus, after previous treatment with alcohol. According to E. Voit[5] *lecithin* was estimated by multiplying the phosphorus figure obtained from the filtered ethereal extract of the fæces with the factor 7·27, corresponding to distearylecithin. The *uric acid* was determined by our own modification of Hopkin's method.[6] The total and ethereal sulphuric acids were estimated according to Baumann's method.[7]

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[1] Der Stoffwechsel des Kindes. Tübingen, 1896.

[2] For this we are indebted to Mr. Droop Richmond of the Aylesbury Dairy Co.

[3] Zeitschr. f. analyt. Chem., 1889, p. 89.

[4] Zeitschr. f. physiol., Chem. xxix., p. 151.

[5] Zeitschr. f. Biologie, xxxvii., p. 555.

[6] Centralbl. f. Physiol., 1897, p. 434. It has been shown by the most recent workers that the initial precipitation of uric acid by means of ammonium chloride is just as reliable as the more complicated method of Salkowski Ludwig when certain conditions are observed. (Ritter, Frolin, Wörner, &c.).

[7] Zeitschr. f. physiol. Chem., i., p. 70. See also Neubauer and Vogel Analyse des Harns, p. 724.

Appendix.

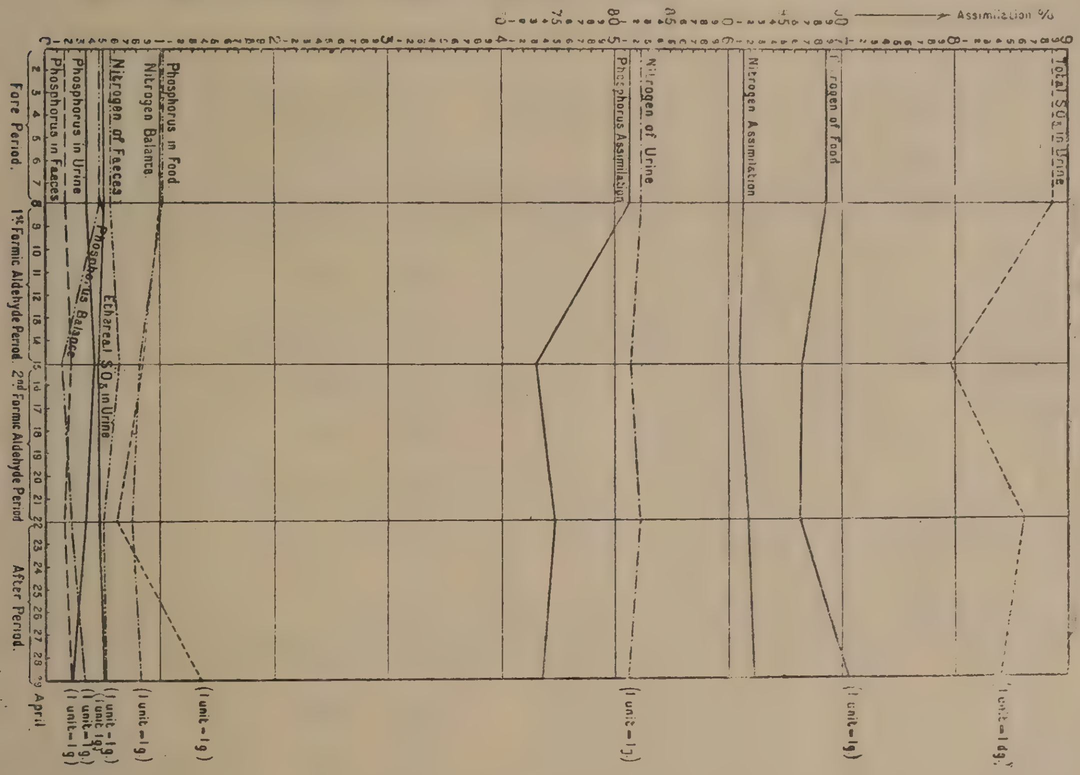
Observation I.—Child A.

The child was a healthy boy, aged 2½ years, weighed 14·6 kilos, and remained in good health throughout the whole observation. He consumed daily as follows :—200 g. of bread, 550 cc. of milk, 20 g. of butter, 30 g. of meat, 50 g. of apple compote, 10 g. of sugar, 50 cc. of water, 5 g. of toffee. This diet was very well taken and adhered to throughout the experiment. The whole observation extended over twenty-eight days, seven days being taken for a fore period and seven days for an after period, during the intermediate fourteen days formic aldehyde was administered. In the first seven days of this intermediate period formic aldhyde was given in the morning and evening milk in such quantity that it was present in the proportion of 1 in 10,000, the actual quantity given per day was 0·05 g., formic aldehyde in 500 cc. of milk. The formic aldehyde was added to the milk in the morning about 7.30 a.m., 250 cc. of the milk were taken at about 8.30 a.m., and 250 cc. at 5 p.m. It will be seen therefore that we not only gave freshly formalised milk, but milk which had been exposed to the action of formic aldehyde for a considerable time. The whole food per diem weighed approximately 900 g. ; it therefore follows that the total food and drink during the first week of the formic aldehyde period was formalised to the extent of 1 in 18,000. During the second formic aldehyde period the dose of formic aldehyde was doubled, viz., 0·10 g. per diem, equal to 1 in 5,000 in milk, and 1 in 9,000 in total food and drink. The increased dose, viz., 0·05 g., was occasionally given with the meal at dinner and occasionally in the milk. The analytical results obtained throughout the observation are recorded in the table on pages 320 and 321.

The results expressed in the table (pages 320 and 321) are graphically represented in the following curves :—

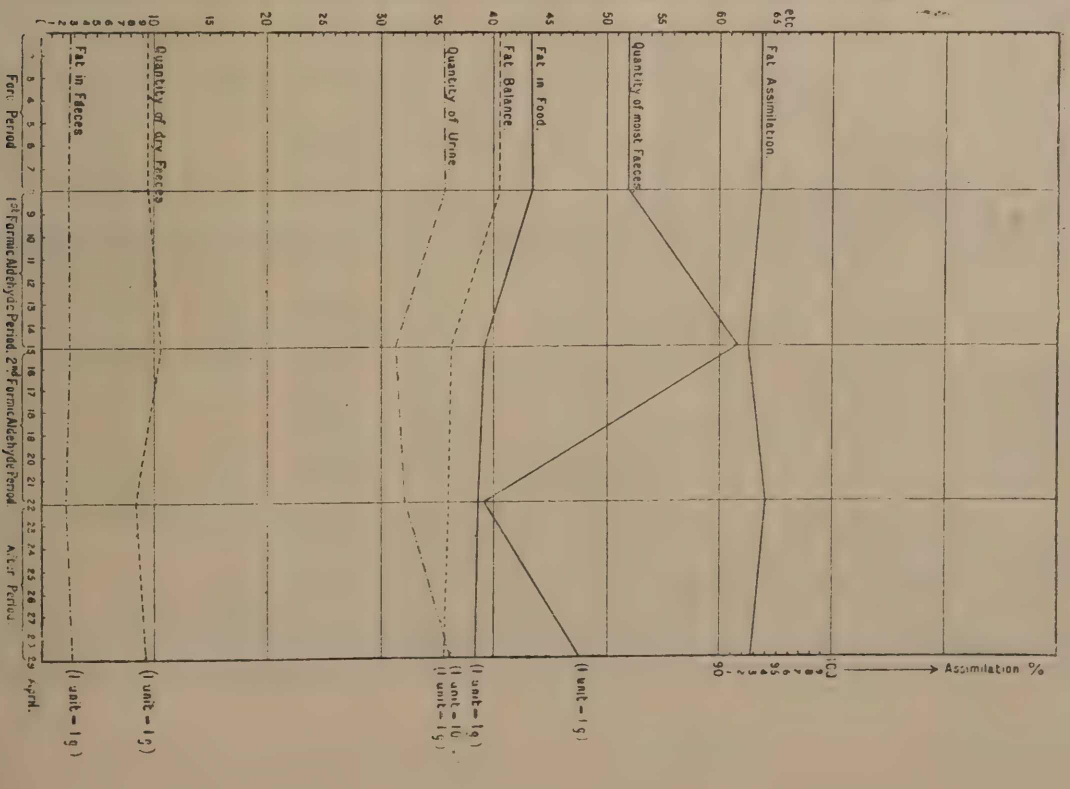
Curve I.

Showing the influence of formic aldehyde upon nitrogen and phosphorus metabolism, &c.



Curve II

Showing the influence of formic aldehyde upon fat assimilation and quantity of fæces and urine.



Appendix.

CHILD A.—TABLE II.

Showing the INFLUENCE of FORMIC ALDEHYDE upon

PERIOD.	——	Date.	Dose.	URINE.						
				Quantity.	Reaction.	Specific Gravity.	Total Sulphuric Acid.	Ethereal Sulphuric Acid.	Uric Acid.	Nitrogen.
FORE PERIOD.		2 IV.		375	Acid.	1·0220	0·8925	0·0533	0·1823	5·07
		3 ,,		375	,,	1·0235	0·8925	0·0533	0·1823	5·35
		4 ,,		410	Amphoteric.	1·0200	1·0016	0 0538	0·2337	5·22
		5 ,,		340	Acid.	1·0250	0·8305	0·0446	0·1938	5·55
		6 ,,		330	,,	1·0230	0·8061	0·0433	0·1881	5·13
		7 ,,		375	Amphoteric.	1·0225	0·9160	0·0492	0·2137	5·05
		8 ,,		320	Acid.	1·0242	0·8841	0·0533	0·2160	5·60
	Total	7 days.		2,525			6·2233	0·3508	1·4099	36·97
	Average	*1 day.*		*360*		*1·0229*	*0·8890*	*0·0501*	*0·2014*	*5·28*
FIRST FORMIC ALDEHYDE PERIOD.		9 IV.	0·05	270	Acid.	1·0269	0·7460	0·0449	0·1822	4·82
		10 ,,	0·05	315	,,	1·0260	0·8703	0·0524	0·2126	5·30
		11 ,,	0·05	320	,,	1·0259	0·8841	0·0532	0·2160	5·42
		12 ,,	0·05	320	,,	1·0260	0·8841	0·0532	0·2160	5·43
		13 ,,	0·05	405	,,	1·0179	0·8925	0·0550	0·2157	4·75
		14 ,,	0·05	320	,,	1·0270	0·7052	0·0435	0·1704	5·55
		15 ,,	0·05	270	,,	1·0289	0·5950	0 0367	0·1438	4·80
	Total	7 days.	0·35	2,220			5·5777	0·3380	1·3567	36·07
	Average	*1 day.*	*0·05*	*317*		*1·0255*	*0·7968*	*0·0484*	*0·1938*	*5·15*
SECOND FORMIC ALDEHYDE PERIOD.		16 IV.	0·1	325	Acid.	1·0260	0·7162	0·0441	0·1731	5·19
		17 ,,	0·1	445	,,	1·0175	0·9860	0·0604	0·2370	4·96
		18 ,,	0·1	315	,,	1·0235	0·9131	0·0494	0·2126	5·19
		19 ,,	0·1	300	,,	1·0240	0·8697	0·0470	0·2025	5·01
		20 ,,	0·1	310	,,	1·0262	0·8986	0·0487	0·2092	5·08
		21 ,,	0·1	270	,,	1·0266	0·7827	0·0423	0·1822	5·33
		22 ,,	0·1	295	,,	1·0293	0·8552	0·0463	0·1991	5·83
	Total	7 days.	0·7	2,260			6·0215	0·3382	1·4157	36·59
	Average	*1 day.*	*0·1*	*323*		*1·0247*	*0·8602*	*0·0483*	*0·2022*	*5·22*
AFTER PERIOD.		23 IV.		355	Acid.	1·0269	0·8516	0·0494	0·1679	5·47
		24 ,,		295	,,	1·0272	0·7077	0·0410	0·1395	5·09
		25 ,,		370	,,	1·0215	0·8875	0·0514	0·1750	4·89
		26 ,,		370	Amphoteric.	1·0230	0·8875	0·0514	0·1750	5·28
		27 ,,		350	Acid.	1·0200	0·8396	0·0487	0·1655	4·47
		28 ,,		415	Amphoteric.	1·0200	0·9396	0·0624	0·2428	6·01
		29 ,,		345	,,	1·0200	0·7811	0·0419	0·2018	4·86
	Total	7 days.		2,500			5·8946	0 3562	1 2675	36·07
	Average	*1 day.*		*360*		*1·0227*	*0·8421*	*0·0509*	*0·1810*	*5·15*

CHILD A.—TABLE II.

the GENERAL METABOLISM of CHILD A., aged 2½ years.

FÆCES.				Nitrogen of Food.	Balance.	Body Weight.	PHOSPHORUS.				FAT.		
Moist.	Dry.	Water %	Nitrogen.				Urine.	Fæces.	Food.	Balance.	Fæces.	Food.	Balance.
65	9·0	86·2	0·56	6·56	+ 0·93	14·61	0·4436	0·1809	1·10	+ 0·48	2·40	44·77	+ 42·37
49	9·2	81·2	0·58	6·81	+ 0·88		0·4436	0 1809	1·16	+ 0·54	2·45	47·02	+ 44·57
64	12·5	85·9	0·78	6·81	+ 0·81		0·3805	0·2440	1·18	+ 0·55	3·33	47·02	+ 43·69
—	—	—	—	6·85	+ 1·30		0·3155	—	1·02	+ 0·70	—	44·84	+ 44·84
68	14·5	78·7	0·84	6·60	+ 0·73		0·3062	0·2779	0·96	+ 0·44	3·81	38·82	+ 35·01
60	11·5	80·8	0 66	7·41	+ 1·70		0·3480	0·2255	0·96	+ 0·39	3·02	40·74	+ 37·72
59	12·4	77·3	0·72	7·16	+ 0·84	14·39	0·4838	9·2365	0·96	+ 0·24	3·26	40·74	+ 37·48
365	69·1		4·14	48·20	+ 7·19	*– 220g.*	2·7212	1·3457	7·34	+ 3·34	18·27	303·95	+ 285·68
52	*96*	*81·7*	*0·59*	*6·88*	+ *1·02*	*Loss*	*0·3887*	*0·1922*	*1·05*	+ *0·48*	*2·61*	*43·42*	+ *40·81*
51	11·4	77·7	0·68	7·16	+ 1·66	14·39	0·4082	0·2463	0·90	+ 0·25	2·97	40·48	+ 37 51
64	11·0	82·8	0·65	7·16	+ 1·21		0·4762	0·2376	0·90	+ 0·19	2·86	40·74	+ 37·88
41	8·4	79·6	0·49	6·79	+ 0·88		0·4838	0·1816	0 90	+ 0·23	2·19	40·74	+ 38·55
88	15·0	82 9	0·90	6·53	+ 0·20		0 4838	0·3242	0·79	– 0·02	3·91	33·79	+ 34 88
—	—	—	—	6·32	+ 1·57		0·4957	—	0·79	+ 0·29	—	38·79	+ 38·79
76	15·2	80·0	0·88	6·33	– 0 10		0·3917	0·3085	0·79	+ 0·09	3·76	38·79	+ 35·03
115	15·2	86 5	0·89	6·33	+ 0·64	14·61	0·3304	0·3147	0·79	+ 0·14	3·83	38·79	+ 34·96
435	76·5		4·49	46·62	+ 6·06	*+ 220g.*	3·0698	1·6129	5·86	+ 1·17	19·52	277·12	+ 257·60
62	*10·9*	*82·6*	*0·64*	*6·66*	+ *0·87*	*Gain*	*0·4385*	*0·2304*	*0·84*	+ *0·17*	*2·79*	*39·59*	+ *36·80*
—	—	—	—	6·33	+ 1·14	14·61	0·3978	—	0·79	+ 0·39	—	38·79	+ 38·79
—	—	—	—	6 38	+ 1·42		0·5447	—	0·79	+ 0·25	—	38·90	+ 38·90
82	20·0	75·6	1·17	6·38	+ 0·02		0·3238	0·4615	0·79	+ 0·00	5·14	38·90	+ 33·76
55	11·2	79·6	0·66	6·38	+ 0·71		0·3084	0·2585	0·79	+ 0·22	2·87	38·90	+ 36·03
70	13·7	80·4	0·80	6·38	+ 0·50		0·3186	0·3162	0·79	+ 0·16	3·52	38·90	+ 35·38
—	—	—	—	6 38	+ 1·05		0·2773	—	0·79	+ 0·51	—	38·90	+ 38·90
65	15·5	76·2	0·91	6·39	– 0·35	14·72	0·3033	0·3577	0·78	+ 0·12	3·98	39·04	+ 35·06
272	60·4		3·54	44·62	+ 4·49	*+ 110g.*	2·4739	1·3939	5·52	+ 1·65	15·51	272·33	+ 256·82
39	*8·6*	*77·9*	*0·51*	*6·37*	+ *0·64*	*Gain*	*0·3534*	*0·1991*	*0·79*	+ *0·23*	*2·22*	*38·90*	+ *36·69*
57	14·8	74·0	0·87	7·31	+ 0·97	14·72	0·1974	0·3326	0·86	+ 0·33	4·08	39·02	+ 34·94
54	10·8	80·0	0·63	7·31	+ 1·59		0·1640	0·2427	0·86	+ 0·45	2·98	39·02	+ 36·04
61	13·2	78·4	0·77	7·39	+ 1·73		0·2057	0·2966	0·86	+ 0·36	3·64	38·31	+ 34·67
48	12 0	75·0	0·67	6·92	+ 0·97		0·2057	0·2882	0·78	+ 0·29	3·04	37·32	+ 34·28
—	—	—	—	6·92	+ 2·45		0·1946	—	0·78	+ 0·59	—	37·46	+ 37·46
—	—	—	—	6·92	+ 0·91		0·2922	—	0·78	+ 0·49	—	37·46	+ 37·46
106	14·9	85·9	0·84	6·92	+ 1·22	15·00	0·2429	0·3579	0·78	+ 0·18	3·78	37·46	+ 33·68
326	65·7		3·78	49·69	+ 9·84	*+ 280g.*	1·5025	1·5180	5·70	+ 2·69	17·52	266·05	+ 248 53
47	*9·4*	*80·0*	*0·54*	*7·09*	+ *1·40*	*Gain*	*0·2146*	*0·2168*	*0·81*	+ *0·38*	*2·70*	*38·01*	+ *35·50*

Appendix.

Referring to the tables and curves relating to the *first observation,* we will classify our remarks under the following headings :—

Nitrogen Metabolism.

In the fore period the daily quantity of nitrogen taken in the food was 6·88 g., of which 0·59 g. was not assimilated, being lost with the fæces, corresponding to 8·58%. The assimilation of nitrogen in the fore period amounted therefore to 91·42%.

With the urine 5·28 g. of nitrogen was excreted, and if this be subtracted from the amount assimilated, we obtain a daily balance of +1·02.

To avoid repetition, we give the results with regard to the nitrogen balance and assimilation during the different periods in tabular form :—

—	Fore Period.	First F.A. Period.	Second F.A. Period.	After Period.
Nitrogen of Food	6·88	6·66	6·37	7·09
„ „ Urine	5·28	5·15	5·22	5·15
„ „ Fæces	0·59	0·64	0·51	0·54
„ Balance	+1·02	+0·87	+0·64	+1·40
„ Assimilation %	91·41	91·22	91·99	92·38
„ of dry Fæces %	6·1	5·9	5·9	5·8

From these results we are justified in drawing the conclusion that the formic aldehyde had no appreciable influence upon proteid metabolism in the case of this child. If, with the necessary restrictions, we regard the nitrogen excreted in the fæces as an index of the digestibility of the food, we find that in this case the addition of formic aldehyde to the proteid constituents of the food has been without influence in this direction. This is best seen from the average percentage of nitrogen in the fæces in the several periods. The assimilation and the balance are likewise not affected.

Phosphorus Metabolism.

The daily average of phosphorus in the food in the fore period was 1·05 g., of which 0·1922 were lost, being excreted in the fæces. Phosphorus was therefore assimilated to the extent of 81·70%. The relative excretion, &c., of phosphorus in the four periods we give in tabular form :—

—	Fore Period.	First F.A. Period.	Second F.A. Period.	After Period.
Phosphorus of Food	1·05	0·84	0·79	0·81
„ „ Urine	0·3887	0·4385	0·3534	0·2146
„ „ Fæces	0·1922	0·2304	0·1991	0·2168
„ Balance	+0·48	+0·17	0·23	+0·38
„ Assimilation %	81·70	72·57	74·80	73·24
„ in dry Fæces %	2·0	2·1	2·3	2·3

From these figures it will be seen that the absolute quantity of phosphorus in the urine in the first formic aldehyde period is slightly increased (·05 g.), in the second formic aldehyde period it falls, however, slightly below the fore period value, and in the after period still further. As at the same time the assimilation of phosphorus as measured by the phosphorus excreted in the fæces is somewhat lessened, it would seem that during the first period formic aldehyde tended to stimulate phosphorus metabolism. The absolute changes are, however, so small, that they can only be regarded as indicating what might be the possible effect of formic aldehyde in much larger doses.

Fat Assimilation.

The daily average of fat in the food during the fore period was 43·42 g.; of this, 2·61 was lost, being excreted with the fæces, leaving a balance of + 40·81 g. The assimilation, therefore, amounted to 93·99%. These results and those of the following periods are recorded in tabular form :—

—	Fore Period.	First F.A. Period.	Second F.A. Period.	After Period.
Fat in Food	43·42	39·59	38·90	38·01
„ „ Fæces	2·61	2·79	2·22	2·70
„ Balance	+40·81	+36·80	+36·69	+35·50
„ Assimilation %	93·99	92·96	94·30	92·90
„ in Fæces %	27·1	25·6	25·8	28·7

From these figures it will be seen that the quantity of fat in the fæces during the formic aldehyde periods did not increase, if anything, decreased in proportion to the fæces. The fat assimilation and fat balance remain unaffected.

In connection with the fat in the fæces, we estimated the *lecithin* according to the method described above. The results expressed as a percentage of total fat are as follows :—

—	Fore Period.	First F.A. Period.	Second F.A. Period.	After Period.
Lecithin in Grammes of 100 Grammes Fat	15·08	11·31	13·16	4·28

As we enter into this subject later, we would only point out here that formic aldehyde seemed to have an influence in diminishing the excretion of lecithin by the fæces, and that this influence extended into the after period.

Having considered the most important factors in metabolism as investigated by us and drawn the conclusion that formic aldehyde had little if any influence upon them, we turn our attention to certain other factors which, although of minor importance, ought not to be overlooked.

On referring to the chief table (Table II.)[1], it will be seen that the total *quantity of urine* in the first formic aldehyde period decreased, whilst the quantity of fæces, and especially their percenrage of water, increased. In the second formic aldehyde period the quantity of urine increased slightly, whilst the quantity of fæces and their water percentage decreased. It would thus seem that formic aldehyde had a tendency to produce a retention of water by the body. A rise in the specific gravity of the urine occurred *pari passu* with its diminution of volume.

If we regard the *uric acid* figures during this observation, we shall see that the average excretion of uric acid during the first formic aldehyde period underwent a very slight diminution along with the total nitrogen, and this would justify us in concluding that the urea and ammonia varied in the same direction. The analytical figures, so far as concerns the average total *sulphuric acid* excretion, show that formic aldehyde exerted upon it a barely appreciable effect, suggesting in connection with the nitrogen figures above, if we draw conclusions from them at all, that formic aldehyde exerted a slightly inhibitory action upon the breaking up of proteids in the body. Even these conclusions can only be applied to the first formic aldehyde period.

The strongly antiseptic properties of formic aldehyde render an inquiry as to its effect upon intestinal putrefaction, as measured by the quantity of ethereal sulphates in the urine, of interest. If we refer to the absolute figures in Table II., we are forced to the conclusion that the slight diminution of ethereal sulphates which occurred during both formic aldehyde periods is not sufficient to indicate any inhibitory effect upon intestinal putrefaction.[2] This seems to show that when formic aldehyde is taken with the food in these proportions, it does not in healthy children occur as such in the intestines.

So far as concerns body weight, it will be observed that there was a slight increase in the two formic aldehyde periods, which seems, however, to be due not to an increased flesh formation or fat retention, but to a retention of water as indicated by the diminished excretion of water in the urine or fæces.

The results relevant to the observations made above are summarised in the following table :—

TABLE IIA.

—	Nitrogen Assimilation %	% N. of Dry Fæces.	Phosphorus Assimilation %	% P. of Dry Fæces.	Fat Assimilation %	% Fat of Dry Fæces.	$\frac{A}{B}$*	$\frac{N}{SO_3}$**
Fore Period - - -	91·42	6·1	81·70	2·0	93·99	27·1	16·7	6·1
First F.A. Period -	91·22	5·9	72·57	2·1	92·96	25·6	15·5	6·4
Second F.A. Period -	91·99	5·9	74·80	2·3	94·30	28·8	16·9	6·1
After Period - -	92·38	5·8	73·24	2·3	92·90	28·7	15·5	6·1

* $\frac{A}{B} = \frac{\text{Inorganic } SO_3}{\text{Ethereal } SO_3}$.

** $\frac{N}{SO_3} = \frac{\text{Nitrogen of Urine}}{SO_3 \text{ of Urine}}$, measuring the degree of proteid metabolism.

Observation II.—Child B.

The child was a healthy boy, aged five years, weighing 17·2 kilos, and remained in good health throughout the whole observation. He consumed daily 250 g. of bread, 600 cc. of milk, 20 g. of butter, 50 g. of meat, 50 g. of apple compote, 10 g. of sugar, 50 cc. of water, and 5 g. of toffee. The duration and arrangement of the observation was as in Child A. The formic aldehyde was administered in an identical manner and dose, but as in this case the total food was slightly increased, the proportion of formic aldehyde in it was slightly less. The analytical results obtained throughout this observation are recorded in the following table :—

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[1] In these remarks throughout the entire paper, we refer to the average daily excretion in question.

[2] The ratio of total sulphuric acid to actual sulphuric acid is likewise not affected, further, as has been pointed by many observers, this ratio is of no special importance.

Appendix.

CHILD B.—TABLE III.

PERIOD.	——	Date.	Dose.	URINE.						
				Quantity.	Reaction.	Specific Gravity.	Total Sulphuric Acid.	Ethereal Sulphuric Acid.	Uric Acid.	Nitrogen.
FORE PERIOD.		2 IV.		340	Acid.	1·0220	0·7782	0·0623	0·1122	4·58
		3 ,,		360	,,	1·0195	0·8240	0·0659	0·1188	4·92
		4 ,,		390	,,	1·0225	1·0600	0·0819	0·1346	6·03
		5 ,,		150	,,	1·0290	0·4076	0·0315	0·0518	2·61
		6 ,,		540	,,	1·0260	1·4674	0·1135	0·1863	9·76
		7 ,,		360	,,	1·0260	0·9783	0·0756	0·1242	6·09
		8 ,,		390	,,	1·0249	1·1890	0·0750	0·1082	6·82
	Total	7 days.		2,530			6·7045	0·5057	0·8361	40·81
	Averag	*1 day.*		*361*		*1·0245*	*0·9578*	*0·0722*	*0·1194*	*5·83*
FIRST FORMIC ALDEHYDE PERIOD.		9 IV.	0·05	300	Acid.	1·0295	0·9146	0·0577	0·0833	6·02
		10 ,,	0·05	325	,,	1·0300	0·9908	0·0625	0·0902	6·82
		11 ,,	0·05	335	,,	1·0280	1·0210	0·0644	0·0929	6·73
		12 ,,	0·05	365	,,	1·0240	1·1130	0·0702	0·1013	5·63
		13 ,,	0·05	345	,,	1·0252	0·9736	0·0627	0·0647	5·78
		14 ,,	0·05	270	,,	1·0300	0·7619	0·0490	0·0506	5·27
		15 ,,	0·05	335	,,	1·0305	0·9453	0·0608	0·0628	6·53
	Total	7 days.	0·35	2,275			6·7202	0·4273	0·5458	42·80
	Average	*1 day.*	*0·05*	*325*		*1·0282*	*0·9600*	*0·0610*	*0·0779*	*6·12*
SECOND FORMIC ALDEHYDE PERIOD.		16 IV.	0·1	345	Acid.	1·0220	0·9736	0·0627	0·0647	5·17
		17 ,,	0·1	410	,,	1·0215	1·1570	0·0745	0·0769	5·82
		18 ,,	0·1	395	,,	1·0226	1·1755	0·0729	0·1185	6·01
		19 ,,	0·1	380	,,	1·0245	1·1131	0·0702	0·1140	6·73
		20 ,,	0·1	280	,,	1·0280	0·8332	0·0517	0·0840	5·35
		21 ,,	0·1	380	,,	1·0255	1·1131	0·0702	0·1140	6·29
		22 ,,	0·1	275	,,	1·0293	0·8183	0·0508	0·0825	5·59
	Total	7 days.	0·7	263			7·1838	0·4530	0·6546	40·96
	Average	*1 day.*	*0·1*	*323*		*1·0247*	*1·0262*	*0·0647*	*0·0935*	*5·85*
AFTER PERIOD.		23 IV.		395	Acid.	1·0276	0·8998	0·0536	0·0593	6·18
		24 ,,		495	,,	1·0180	1·1276	0·0672	0·0743	5·49
		25 ,,		410	,,	1·0275	0·9337	0·0537	0·0615	7·39
		26 ,,		535	,,	1·0190	1·2184	0·0726	0·0803	6·41
		27 ,,		480	,,	1·0210	1·0934	0·0652	0·0720	6·55
		28 ,,		560	,,	1·0190	1·2710	0·0795	0·0420	7·38
		29 ,,		455	,,	1·0200	1·0330	0·0646	0·0341	6·62
	Total	7 days.		3,330			7·5769	0·4584	0·4235	46·02
	Average	*1 day.*		*476*		*1·0216*	*1·0824*	*0·0655*	*0·0605*	*6·57*

Child B.—Table III.

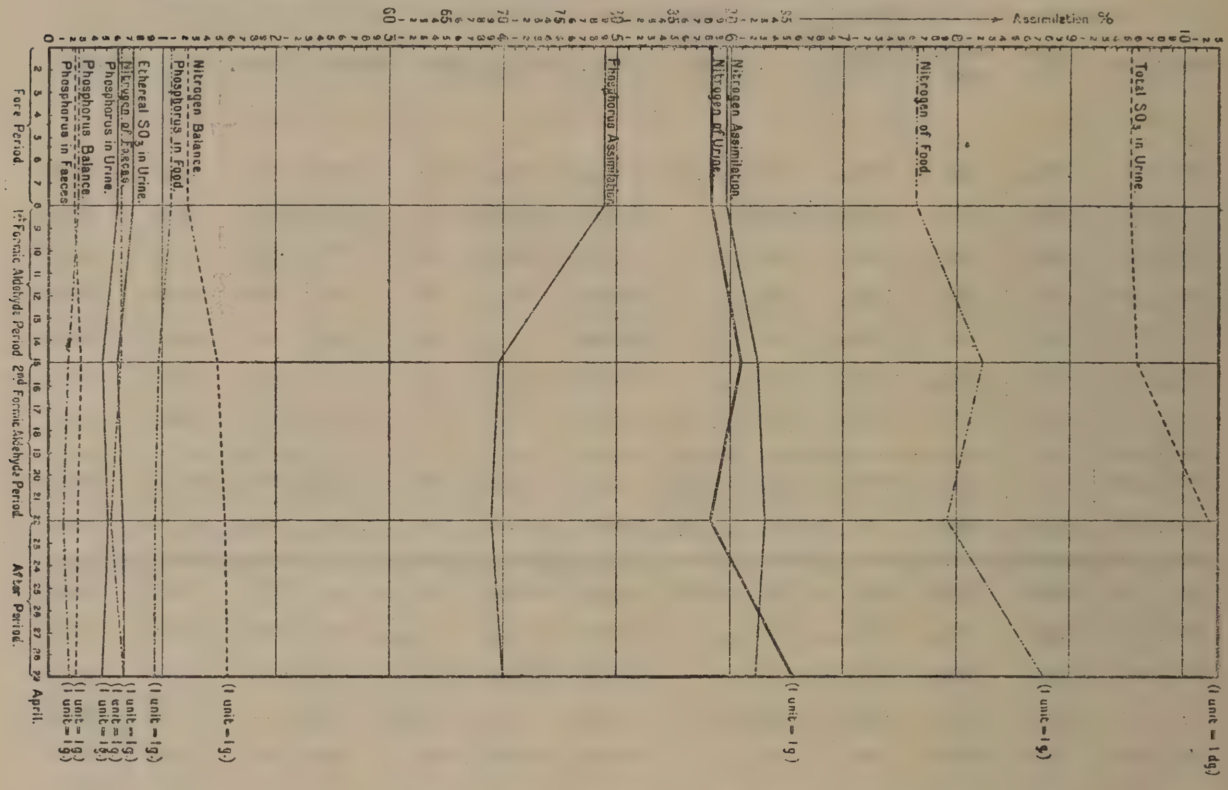
FÆCES.							PHOSPHORUS.				FAT.		
Moist.	Dry.	Water %	Nitrogen.	Nitrogen of Food.	Balance.	Body Weight. kg.	Urine.	Fæces.	Food.	Balance.	Fæces.	Food.	Balance.
85	19·5	77·1	1·24	7·15	+1·33	17·21	0·8092	0·3918	1·14	− 0·06	4·87	45·85	+ 40·98
7	2·2	68·6	0·14	7·40	+2·34		0·8568	0·0454	1·20	+ 0·30	0·56	48·10	+ 47·54
56	13·0	76·8	0·85	7·40	+0·52		0·5413	0·2681	1·20	+ 0·39	2·33	48·10	+ 44·77
112	21·5	80·8	1·24	7·44	+3·59		0·2082	0·5215	1·07	+ 0·34	5·59	45·00	+ 39·41
—	—	—	—	7·19	−2·57		0·7495	—	1·01	+ 0·26	—	38·98	+ 38·98
57	15·4	73·0	0·89	8·01	+1·03		0·4994	0·3736	1·01	+ 0·14	4·01	40·90	+ 36·89
—	—	—	—	9·17	+2·35	17·27	0·5974	—	1·05	+ 0·45	—	40·96	+ 40·96
317	71·6		4·36	53·76	+8·59	*Total Gain*	4·2618	1·6004	7·68	+ 0·82	18·36	307·89	+ 289·53
45	*10·2*	*77·4*	*0·62*	*7·68*	*+1·23*	*+60g.*	*0·6088*	*0·2280*	*1·09*	*+ 0·26*	*2·62*	*43·98*	*+ 41·36*
9	3·0	66·7	0·22	8·82	+2·58	17·27	0·4596	0·0798	1·04	+ 0·50	0·71	43·72	+ 43·01
39	8·0	79·5	0·57	8·82	+1·43		0·4979	0·2128	1·04	+ 0·33	1·90	43·72	+ 41·82
126	31·7	74·8	2·28	8·37	−0·64		0·5132	0·8432	1·04	− 0·32	7·54	44·04	+ 36·50
—	—	—	—	8·06	+2·43		0·5592	—	0·92	+ 0·36	—	41·92	+ 41·92
81	17·5	78·4	0·58	7·84	+1·48		0·4982	0·4449	0·92	− 0·02	4·16	41·92	+ 37·76
—	—	—	—	7·85	+2·58		0·3899	—	0·92	+ 0·53	—	41·92	+ 41·92
75	20·0	73·3	0·67	7·85	+0·63		0·4838	0·5085	0·92	− 0·07	4·75	41·92	+ 37·17
330	80·2		4·32	57·61	+10·49		3·4018	2·0892	6·80	+ 1·32	19·06	299·16	+ 280·07
47	*11·5*	*75·7*	*0·62*	*8·23*	*+1·49*		*0·4859*	*0·2984*	*0·97*	*+ 0·19*	*2·72*	*42·73*	*+ 40·01*
—	—	—	—	7·85	+2·68		0·4982	—	0·92	+ 0·42	—	41·92	+ 41·92
100	24·5	75·5	0·80	7·95	+1·33		0·5920	0·6229	0·92	− 0·29	5·82	42·10	+ 36·28
—	—	—	—	7·95	+1·94		0·5799	—	0·92	+ 0·34	—	42·10	+ 42·10
54	9·0	83·3	0·53	7·95	+0·69		0·5579	0·2384	0·92	+ 0·12	2·25	42·10	+ 39·85
85	21·6	74·6	1·26	7·95	+1·34		0·4110	0·5722	0·92	− 0·06	5·41	42·10	+ 36·69
19	5·3	72·1	0·31	7·95	+1·35		0·5579	0·1404	0·92	+ 0·22	1·33	42·10	+ 40·77
57	15·7	72·5	0·92	8·06	+1·55	17·49	0·4037	0·4159	0·91	+ 0·09	3·93	42·33	+ 38·40
315	76·1		3·82	55·66	+10·88	*Total Gain*	3·6006	1·9898	6·43	+ 0·84	18·74	294·65	+ 276·01
45	*10·8*	*75·8*	*0·54*	*7·95*	*+1·56*	*+270*	*0·5143*	*0·2842*	*0·92*	*+ 0·12*	*2·68*	*42·09*	*+ 39·43*
50	11·6	76·8	0·69	8·76	+1·89	17·49	0·4298	0·2679	1·01	+ 0·31	2·53	42·31	+ 39·78
—	—	—	—	9·21	+3·72		0·5386	—	1·01	+ 0·47	—	42·31	+ 42·31
88	21·8	75·0	1·31	9·31	+0·61		0·4461	0·5034	1·01	+ 0·06	4·75	41·53	+ 36·78
—	—	—	—	8·59	+2·18		0·5820	—	0·91	+ 0·33	—	39·93	+ 39·98
51	12·4	75·7	0·75	8·59	+1·29		0·5222	0·3289	0·91	+ 0·06	2·77	40·12	+ 37·35
61	14·9	75·6	0·89	8·59	+0·32		0·4816	0·3952	0·91	+ 0·03	3·32	40·12	+ 36·80
83	16·2	81·4	0·97	8·59	+1·00	17·49	0·3913	0·4296	0·91	+ 0·09	3·62	40·12	+ 36·50
337	76·9		4·61	61·64	+11·01	*Gain.*	3·3916	1·9250	6·67	+ 1·35	16·99	306·49	+ 269·50
48	*10·9*	*77·2*	*0·66*	*8·30*	*+1·57*	*±0*	*0·4845*	*0·2750*	*0·95*	*+ 0·19*	*2·42*	*43·78*	*+ 38·50*

Appendix.

The results expressed in the above table are graphically represented in the following curves :—

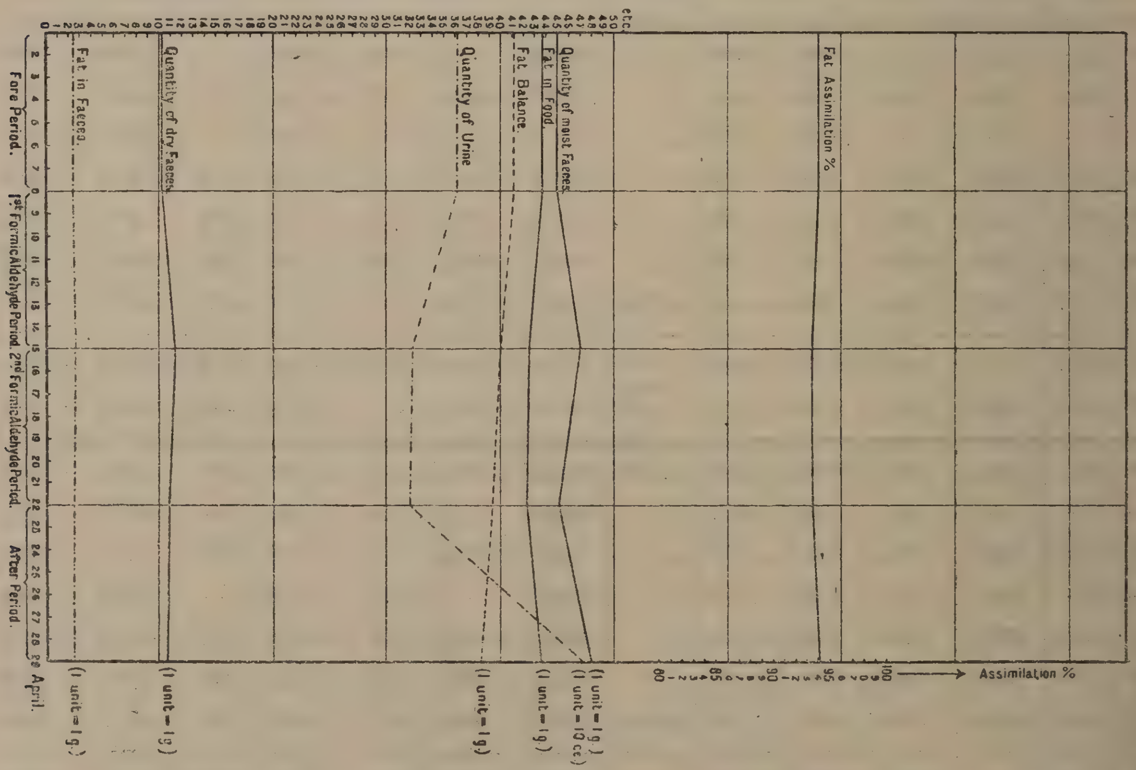
Curve III.

Showing the influence of formic aldehyde upon nitrogen and phosphorus metabolism, etc



Curve IV.

Showing the influence of formic aldehyde upon fat assimilation and the quantity of fæces and urine.



Appendix.

Nitrogen Metabolism.

Adopting the same method of reasoning as in Observation I. we arrive at the following results with regard o the nitrogen balance and assimilation. These are best expressed in a tabular form.

—	Fore Period.	First F.A. Period.	Second F.A. Period.	After Period.
Nitrogen of Food	7·68	8·23	7·95	8·80
„ „ Urine	5·83	6·12	5·85	6·57
„ „ Fæces	0·62	0·62	0·54	0·66
„ Balance	+1·23	+1·49	+1·56	+1·57
„ Assimilation %	89·82	92·46	93·21	92·50
„ in dry Fæces %	6·0	5·4	5·0	6·0

From these results we can draw the conclusion that formic aldehyde in both periods, seemed to have a slightly beneficial effect upon proteid assimilation. This is indicated by a rise in the percentage of nitrogenous food assimilated. The nitrogen percentage of the fæces shows a diminution. This result may find an explanation in a stimulating action of formic aldehyde upon the secretion of the digestive enzymes.

Phosphorus Metabolism.

The results in this connection expressed in a tabular form are as follows :—

—	Fore Period.	First F.A. Period.	Second F.A. Period.	After Period.
Phosphorus of Food	1·09	0·97	0·92	0·95
„ „ Urine	0·6088	0·4859	0·5413	0·4845
„ „ Fæces	0·2286	0·2984	0·2842	0·2750
„ Balance	+0·26	+0·19	+0·12	+0·19
„ Assimilation %	79·03	69·23	69·11	71·05
„ in dry Fæces %	2·2	2·6	2·6	2·5

From the above table it will be seen that the absolute differences in the several periods are small. Nevertheless if any positive conclusion may be drawn, it is in this case the formic aldehyde had a slightly depressing effect upon the assimilation of phosphorus as expressed by the slight increase of the phosphorus in the fæces. It must not be overlooked that the percentage figures in this case are a very large magnification of the absolute variations in amount. The formic aldehyde seemed to have no influence in stimulating the breaking down of the phosphorus-containing substances in the body itself; in fact there seems to be a suggestion, from the diminished amount of phosphorus in the urine, that it acted in the opposite direction.

Fat Assimilation.

As in the preceding cases, we express these results for the sake of convenience in the following table :—

—	Fore Period.	First F. A. Period.	Second F. A. Period.	After Period.
Fat in Food	43·98	42·73	42·09	43·78
„ „ Fæces	2·62	2·72	2·68	2·42
„ Balance	+41·36	+40·01	+39·43	8·50
„ Assimilation %	94·05	93·63	93·63	94·47
„ in dry Fæces %	25·7	23·7	24·8	22·1

From these figures it will be seen that the remarks we made with regard to the effect of formic aldehyde upon fat assimilation in Observation I. hold good in this case—viz., that there is no influence.

Appendix.

In so far as concerns lecithin the following figures express our result :—

——	Fore Period.	First F.A. Period.	Second F.A. Period.	After Period.
Lecithin in Grammes of 100 Grammes Fat	21·09	22·60	14·59	17·30

Formic aldehyde seems to have the same influence here as in Observation I.

With regard to the remaining factors of general metabolism, in this case it will be seen from the chief table (Table III.) that the *quantity of urine*, as in Observation I., decreased in the first formic aldehyde period, but that the influence upon the quantity of fæces and their water content is less marked. In the second formic aldehyde period the quantity of urine continued to be less than that of the fore period, whilst the *quantity of fæces* and their water content remained practically constant. In the after period the quantity of urine increased to an amount exceeding that of the fore period. The quantity of fæces and their water content remained also in this period constant. It would seem therefore, as in the former case, formic aldehyde had a tendency to cause a retention of water in the body. The reaction of the urine remained acid through the whole observation. The The *uric acid* excretion diminished to some extent in the formic aldehyde period, while the total nitrogen and the total sulphuric acid remained practically unaffected. If the slightness of the changes do not preclude us from drawing any conclusions at all, we should infer that in this case formic aldehyde exerted a specific action upon either the formation or retention of uric acid. The result in this case is the more interesting in that this child seemed to belong to the uric acid type. Under the influence of formic aldehyde the *ethereal sulphates* of the urine underwent a slight diminution ; this was more pronounced than in Observation I. There seemed, however, to be practically no action upon intestinal putrefaction. We are the more entitled to draw this conclusion as the indoxyl reaction was equally intense throughout the whole observation. The *body weight* as in the former observation went up in the formic aldehyde period and remained constant in the after period. The increase in the formic aldehyde periods must be ascribed rather to a retention of water than to actual growth. We may epitomise the above observations in tabular form as follows :—

TABLE IIIA.

——	Nitrogen Assimilation %	% N. in Dry Fæces.	Phosphorus Assimilation %	% P. in Dry Fæces.	Fat Assimilation %	% Fat in Dry Fæces.	$\frac{A}{B}$*	$\frac{N}{SO}$**
Fore Period - - -	91·42	6·1	81·00	2·0	93·99	27·1	16·7	6·1
First F.A. Period - -	91·22	5·9	72·57	2·1	92·96	25·6	15·5	6·4
Second F.A. Period -	91·99	5·9	74·80	2·3	94·30	25·8	16·9	6·1
After Period - - -	92·38	5·8	73·24	2·3	92·99	28·7	15·5	6·1

* $\frac{A}{B} = \frac{\text{Inorganic } SO_3}{\text{Ethereal } SO_3}$

** $\frac{N}{SO_3} = \frac{\text{Nitrogen of Urine,}}{SO_3 \text{ of Urine}}$ measuring the degree of proteid metabolism.

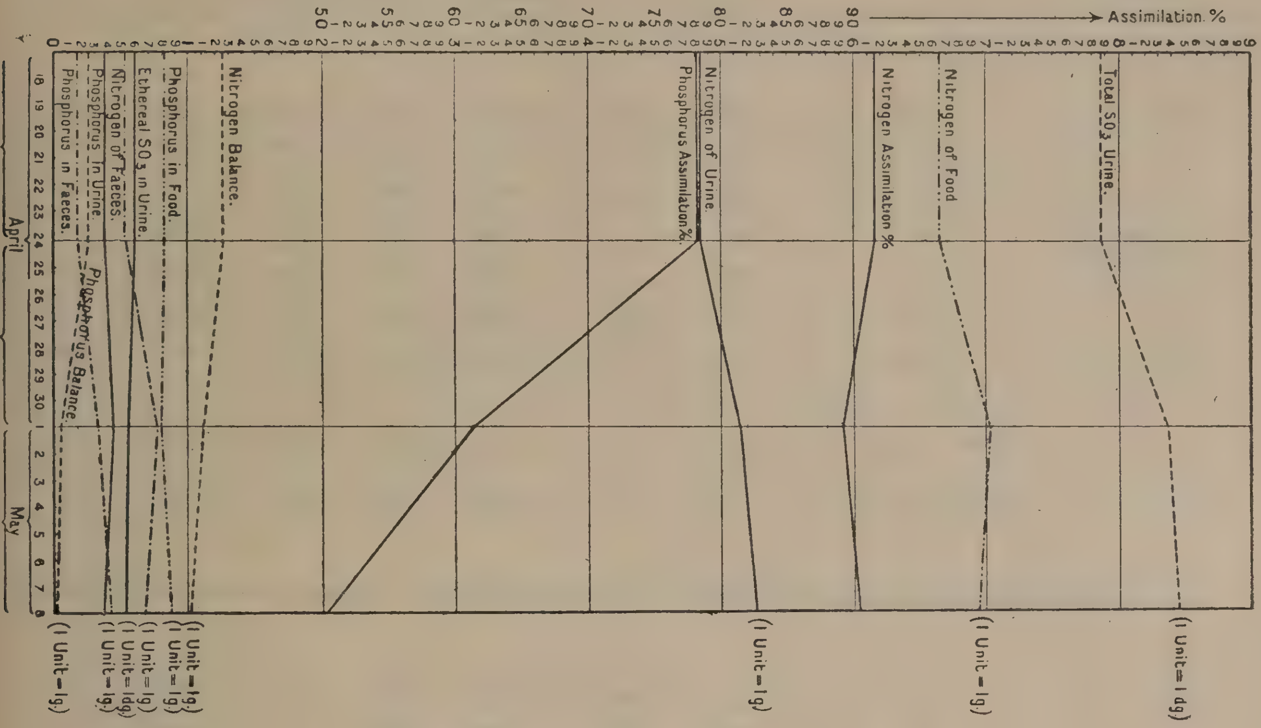
Observation III.—Child C.

This child was a delicate girl, aged four years ; she was convalescent from pneumonia, and was, as compared with the other children, ill nourished, and poorly developed. Her weight was 15 kilos. She consumed daily 200 g. of bread, 550 cc. of milk, 20 g. of butter, 30 g. of meat, 50 g. of apple compote, 10 g. of sugar, 50 cc. of water, 5 g. of toffee. The observation lasted for twenty-one days ; seven days were used as fore period, seven days as formic aldehyde period, and seven days as after period. The method of administering the formic aldehyde was the same as in the previous observations, but it was given in this case throughout in a concentration of 1 in 5,000 of milk, occasionally some of the formic aldehyde was given in the meat ; the total food was formalised to the extent of 1 in 9,000. The total quantity given per diem was 0·1 g. The child's general health and behaviour did not seem to be affected in any way throughout the whole observation.

The results expressed in the table on pages 330 and 331 are graphically represented in the following curves :—

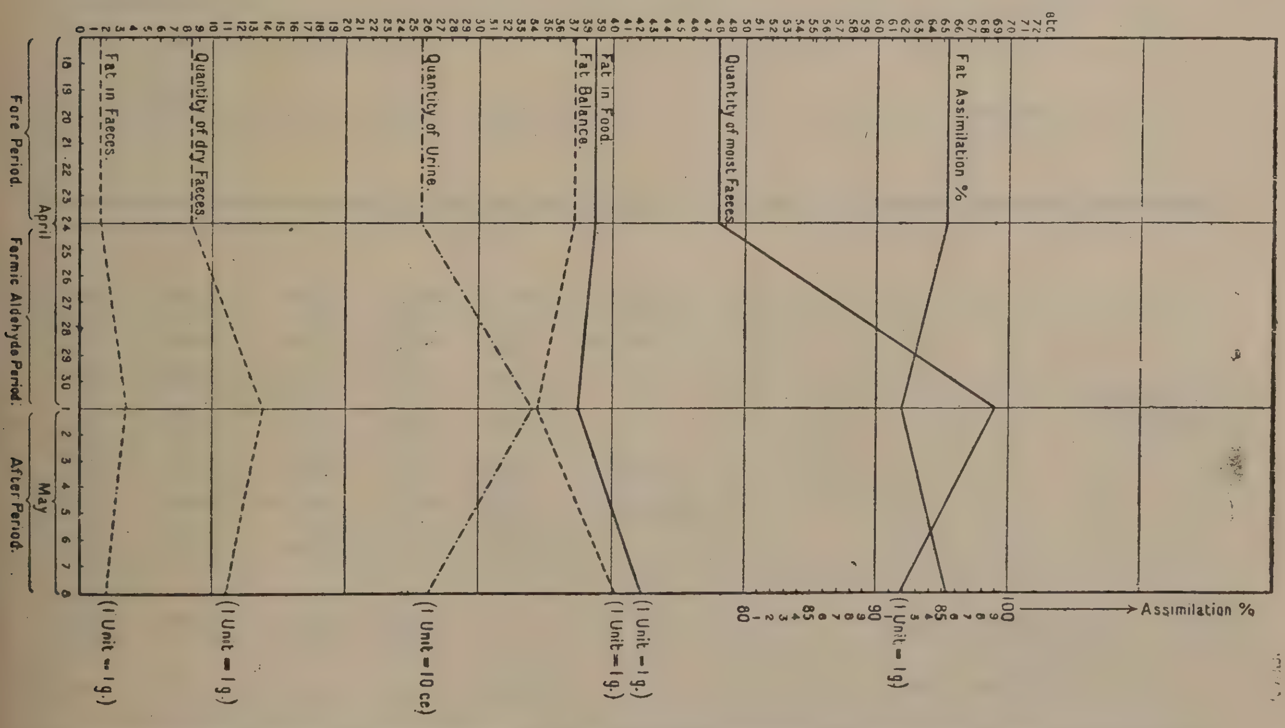
Curve V.

Showing the influence of formic aldehyde upon phosphorus and nitrogen metabolism.



Curve VI.

Showing the influence of formic aldehyde upon fat assimilation and upon the quantity of urine and fæces.



The analytical results obtained throughout this observation are recorded in the following table :—

Appendix.

CHILD C.—TABLE IV.

PERIOD.	——	Date.	Dose.	URINE.						
				Quantity.	Reaction.	Specific Gravity.	Total Sulphuric Acid.	Ethereal Sulphuric Acid.	Uric Acid.	Nitrogen.
FORE PERIOD.		18 IV.		265	Acid.	1·0260	0·8326	0·0684	0·1187	4·62
		19 ,,		245	,,	1·0288	0·7618	0 0632	0·1097	4·76
		20 ,,		275	,,	1·0287	0·8640	0·0709	0·1232	4·86
		21 ,,		280	,,	1·0292	0·8798	0·0722	0·1253	4·72
		22 ,,		205	,,	1·0316	0·6441	0·0529	0·1918	4 20
		23 ,,		330	,,	1·0300	0 8038	0·0498	0·1795	5·83
		24 ,,		305	,,	1·0250	0·7430	0·0461	0·1659	4·86
	Total	7 days.		1,905			5·5291	0·4235	1·0141	33·85
	Average	*1 day.*		*258*		*1·0282*	*0·7898*	*0·0605*	*0·1306*	*4·84*
FORMIC ALDEHYDE PERIOD.		25 IV.	0·1	360	Amphoteric.	1·0270	0 8769	0·0544	0·1958	5·64
		26 ,,	0·1	250	Acid.	1·0190	0·6090	0·0378	0·1360	3·21
		27 ,,	0·1	420	Amphoteric.	1·0180	1·0208	0·0634	0·2285	5·33
		28 ,,	0·1	335	,,	1·0250	0·8348	0·0556	0 1715	5·84
		29 ,,	0·1	340	,,	1·0230	0·8473	0·0564	0·1740	5·13
		31 ,,	0·1	260	,,	1·0180	0·6479	0 0432	0·1331	2·89
		1 V.	0·1	415	Acid.	1·0250	1·0340	0·0689	0·2124	7·88
	Total	7 days.	0·7	2,380			5·8707	0·3797	1 2513	35·92
	Average	*1 day.*	*0·1*	*340*		*1·0221*	*0·8386*	*0·0542*	*0·1787*	*5·13*
AFTER PERIOD.		2 V.		300	Acid.	1·0281	0·9141	0·0609	0·1008	5·24
		3 ,,		275	Amphoteric.	1·0272	0·8379	0·0558	0·0924	4·92
		4 ,,		280	,,	1·0286	0·8532	0·0568	0·0940	5·68
		5 ,,		270	,,	1·0293	0·8227	0·0548	0·0907	5 01
		6 ,,		260	Acid.	1·0293	0·7922	0·0528	0 0874	6·57
		7 ,,		210	Amphoteric.	1·0276	0·7757	0·0379	0·0189	3·81
		8 ,,		255	,,	1·0318	0·9227	0·0450	0 0229	5·80
	Total	7 days.		1,850			59·185	0·3640	0·5071	37·03
	Average	*1 day.*		*264*		*1·0288*	*0·8455*	*0·0520*	*0 0724*	*5·29*

Appendix.

Child C.—Table IV.

FÆCES.				Nitrogen of Food.	Balance.	Body Weight.	PHOSPHORUS.				FAT.		
Moist.	Dry.	Water %	Nitrogen.				Urine.	Fæces.	Food.	Balance.	Fæces.	Food.	Balance.
97	14·0	85·6	0·89	6·35	+0·84	15·06	0·4123	0·2915	0·79	+0 09	2·94	38 90	+ 35·96
—	—	—	—	6·35	+1·59		0·3813	—	0·79	+0·41	—	38 90	+ 38 90
63	12·5	80·2	0·80	6·35	+0·69		0·4279	0 2602	0·79	+0·10	2·63	38·90	+ 36·27
—	—	—	—	6·35	+1·63		0·4357	—	0·79	+0·35	—	38·90	+ 38·90
100	20 0	80·0	1·27	6·44	+0·97		0·3189	0·4164	0·78	+0·04	4·20	39·04	+ 34·84
75	12·7	83·1	0 82	7·36	+0·71		0·3683	0·2644	0·86	+0·23	2·67	39 02	+ 36·35
—	—	—	—	7·36	+2·50	15 12	0·3402	—	0·86	+0·52	—	39 02	+ 39 02
335	59·2		3·78	46·56	+8·93	+*60g.*	2·6846	1 2325	5·66	+1·74	12·44	272·68	+260·24
48	*8·4*	*82·3*	*0·54*	*6·65*	*+1·27*	Gain	*0·3835*	*0·1760*	*0·81*	*+0·25*	*1·77*	*38·95*	*+ 37·18*
54	15·7	72·8	0·84	7·45	+0·97	15·12	0·4016	0·3532	0·86	+0·11	3·57	38·31	+ 34·74
77	15·0	80·5	0·81	6·89	+2·87		0 2790	0·3375	0 78	+0·16	3·41	37·32	+ 33 91
69	11 6	83·2	0·63	6·89	+0·93		0·4687	0·2610	0·78	+0·05	2·63	37·46	+ 34·83
37	10·3	72·2	0 56	6 89	+0·49		0·4559	0·2317	0·78	+0·09	2·34	37·46	+ 35·12
136	21·9	83 9	1·32	6·89	+0·44		0·4637	0·4861	0 78	−0 17	4·98	37·46	+ 32·48
35	7·5	78·6	0·45	7·05	+3·71		0·3546	0·1664	0·78	+0 26	1·71	37·56	+ 35·85
74	13·5	81·8	0·81	7·05	−1·64	15·40	0·5660	0·2996	0·78	−0·09	3·07	37·56	+ 34·49
482	95·5		5·42	49·11	+7·77	+*280g.*	2·9895	2·1355	5·54	+0·41	21·71	263·13	+241·42
69	*13·6*	*80·3*	*0·77*	*7·01*	*+1·11*	Gain	*0·4270*	*0·3050*	*0·79*	*+0·06*	*3·10*	*37·59*	*+ 34·49*
21	4·4	79·0	0·30	7·08	+1·54	15·40	0·4119	0·5114	0·78	−0·14	0·89	37·56	+ 36·67
113	22·0	80·5	1·49	7·08	+0·67		0·3774	0·1023	0·78	+0 30	3·16	37·56	+ 34·40
28	3·6	87·1	0·21	7·06	+1·17		0·3843	0·9736	0 84	−0·52	0·68	36·20	+ 35·52
105	18·1	82·7	1·07	6·92	+0·85		0 3705	0·4895	0·84	−0·02	3·43	45·78	+ 42·35
47	8·5	81·9	0·51	6·92	−0·16		0 3568	0·2299	0·84	+0·25	1·61	45·78	+ 44·17
87	13·9	84·0	0·83	6·92	+2·28		0·3533	0·3759	0·84	+0·11	2·63	45·78	+ 43·15
31	6·6	78·7	0·39	6·97	+0·78	15·62	0·4289	0·1785	0·84	+0 23	1·25	45·78	+ 44·53
432	77·1		4·80	48·95	+7·13	+*220g.*	2·6831	2·8611	76	+0·22	13·65	294·44	+280·79
62	*11·0*	*81·9*	*0·68*	*6 99*	*+1·02*	Gain	*0·3833*	*0·4087*	*0·82*	*+0 03*	*1·95*	*42·06*	*+ 40·11*

Appendix.

Nitrogen Metabolism.

Following the same methods as before, the results in this connection are expressed in tabular form as follows :—

—	Fore Period.	F. A. Period.	After Period.
Nitrogen in Food per diem	6·65	7·01	6·99
,, ,, Urine ,, ,,	4·84	5·13	5·29
,, ,, Fæces ,, ,,	0·54	0·77	0·68
,, Balance ,, ,,	+1·27	+1·11	+1·02
,, Assimilation %	91·88	89·01	90·27
,, in dry Fæces %	6·4	5·7	6·2

From these figures, speaking generally, we cannot say that the nitrogenous metabolism was to any extent affected. The quantity of nitrogen in the fæces, however, was certainly increased, and the effect seemed to be prolonged into the after period. The difference in absolute quantity as compared to the fore period is, however, very small (0·23 grammes in the formic aldehyde period, and 0·14 grammes in the after period). If one were to regard this result superficially, one would be tempted to at once draw the conclusion that formic aldehyde in this proportion, viz., 1 in 5,000, had rendered the proteid constituents of the food less digestible. Upon closer inspection, however, it seems that this increase of nitrogen in the fæces is rather to be explained by formic aldehyde exerting a slight irritant action upon the intestine, involving an increased shedding of epithelial cells. We are brought to this conclusion by the fact that the total quantity of the fæces was increased, and that the effect was prolonged into the after period. In this connection, however, we must not overlook the possibility of formic aldehyde exerting an inhibitory action upon the *secretion* of the digestive enzymes. As we shall discuss this later in another connection we shall say nothing further about it here.

Phosphorus Metabolism.

The results in this connection expressed in a tabular form are as follows :—

—	Fore Period.	F. A. Period.	After Period.
Phosphorus of Food per diem	0·81	0·79	0·82
,, ,, Urine ,, ,,	0·3835	0·4270	0·3833
,, ,, Fæces ,, ,,	0·1760	0·3050	0·4087
,, Balance	+0·25	+0·06	+0·08
,, Assimilation %	78·28	61·89	50·16
,, in dry Fæces %	2·1	2·2	3·7

From these figures we come to the conclusion that the phosphorus balance, although approaching nearer to the equilibrium during the formic aldehyde, and after period, never actually reached it, and hence cannot be considered to have been seriously affected. On the other hand, reasoning from the increased amount of phosphorus in the fæces, there can be no doubt that, speaking generally, the phosphorus of the food has not been assimilated during the formic aldehyde and after periods, to the same extent as during the fore period. Further, taking into consideration the increased amount of phosphorus in the urine during the formic aldehyde period, along with the diminished assimilation and the fact that the phosphorus in the food remained constant, formic aldehyde seemed to exert a slight stimulating action upon the breaking down of the body proteids rich in phosphorus.

As this case affords the first example of tangible increase in the phosphorus of the fæces, we examined it more carefully. Keeping in mind the results of the experiments *in vitro*, a probable explanation appeared to be that the formalisation of the proteid constituents of the food had rendered them less susceptible to the action of the pancreatic secretion. It must be remembered, however, in this connection that the pancreatic juice acts upon the residue of gastric digestion, the phosphorus containing compounds of which are chiefly nucleo-proteids and nucleo-albumins. An indication of the extent to which pancreatic digestion was deranged would be given by an estimation of the nucleo-proteid and nucleo-albumin phosphorus in the fæces. This we proceeded to do, following generally the method described by Knopfelmacher[1] and modified by Muller.[2] It must be noted at once, however, that this method is not an absolute analytical one, but simply comparative.[3]

Another possible explanation of the increased amount of phosphorus in the fæces would be an increased excretion of lecithin with them. Our attention was drawn to the possibility of this explanation by the fact, as will be seen later, that the substances soluble in ether in the fæces were actually increased during the formic aldehyde period. We proceeded, therefore, to estimate the phosphorus due to lecithin, and found it, contrary to our expectation, to have considerably decreased during the formic aldehyde period.

Having obtained the figures for phosphorus due to lecithin and due to nucleo-proteids, we were enabled, by subtraction of their sum from the total phosphorus, to obtain a phosphorus value representing in all probability inorganic phosphorus.

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[1] Wiener klin. Wochenschr., 1898, no. 45.

[3] Zeitschr. f. Biologie, 1900, p. 451.

[2] The fæces (about 5 g.) freed from fat were ground up with 200 cc. of dilute HCl, containing some tannic acid, to fix the nucleo-proteid phosphorus. After twenty-four hours standing the mixture was filtered, and washed with the tannic acid HCl. solution till 100 cc. of the washings contained no trace of phosphoric acid. Phosphorus was then estimated in the residue by Neumann's method, described under general methods.

These results in a tabular form are as follows :—

—	Total P.	Nucleo Proteid P.	Lecithin P.	Inorganic P.
Fore Period	0·1760	0·0085	0·0226	0·1459
Formic Aldehyde Period	0·3050	0·0178	0·0086	0·2786
After Period	0·4087	0·0149	0·0264	0·3674

It will be seen from the above table that the nucleo-proteids of the fæces as measured by their phosphorus content are increased, and from this we are justified in concluding that formic aldehyde has exerted some influence upon their digestion. Since this effect is continued into the after period, the conclusion seems justified that it is due rather to a specific action upon the secretion of the pancreatic enzymes than to a diminished digestibility of the food. Whatever explanation of the increase in nucleo-proteids we may adopt, this latter is not sufficient of itself to explain the actual increase in the total phosphorus ; much less does the lecithin afford an explanation of this. We are forced, therefore, to assume that the increased phosphorus excretion is due mainly to an increased excretion of what we have termed inorganic phosphorus. A further confirmation of this conclusion would be found in an increased excretion by the fæces of those bases with which phosphoric acid is usually combined in an insoluble form—viz., calcium and magnesium. A quantitative analysis of the fæces in this respect showed an actual increase, proportional to that of the inorganic phosphorus, in these bases during the formic aldehyde and after periods. The results are expressed in the following table :—

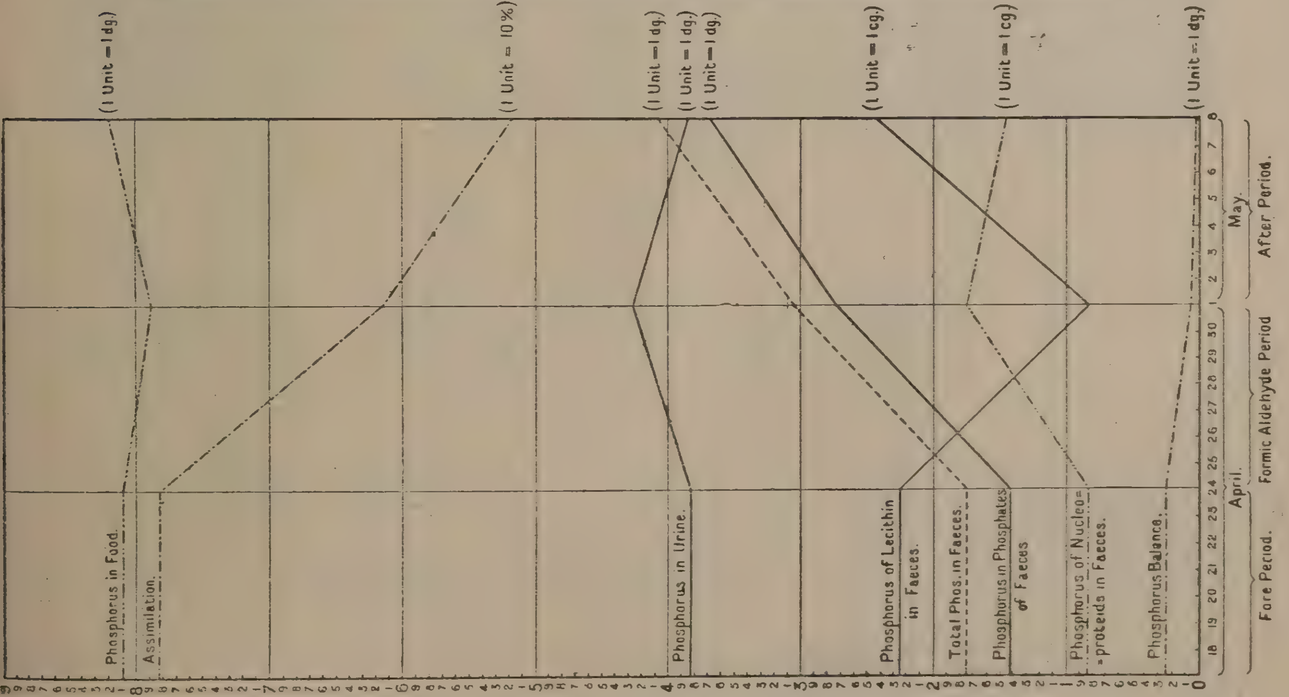
—	% Ash of Fæces.	Absolute Amount.		% CaO of Ash.	% MgO of Ash.
		CaO per diem.	MgO per diem.		
Fore Period	22·11	0·6654	0·0674	3·58	0·36
Formic Aldehyde Period	32·51	1·2139	0·1162	3·96	0·38
After Period	20·77	0·8688	0·0829	3·84	0·36

Taking all these results into consideration, we should be inclined to conclude that the increase of phosphorus in the fæces depends upon an increase in inorganic phosphorus, due to the co-operation of two causes. Firstly, to a stimulating action exerted by formic aldehyde, or, more probably, formic acid, upon the intestinal secretion ; and, secondly, to a less extent, to an increased splitting up of lecithin and the transformation of the glycero-phosphoric acid produced into insoluble phosphates.[1]

In this instance we thought the phosphorus metabolism sufficiently interesting to have its results incorporated in a curve.

Curve VII.

Representing graphically the phosphorus metabolism under formic aldehyde in a delicate child.



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[1] Noel Paton (Journ. of Physiol., 1900) found that the calcium salt of glycero-phosphoric acid administered to a goat was excreted in the fæces as inorganic phosphate

Fat Assimilation.

The results are, as in former cases, represented in tabular form :—

—	Fore Period.	F.A. Period.	After Period.
Fat in Food	38·95	37·59	42·06
„ „ Fæces	1·77	3·10	1·95
„ Balance	+37·18	+34·49	+40·11
„ Assimilation %	95·46	91·75	95·37
„ in dry Fæces %	21·1	22·9	17·7

It will be seen from these figures that formic aldehyde interfered in this case with the assimilation of the fat of the food. The interference did not extend into the after period. From this latter fact we may conclude that in this case formic aldehyde exerted a specific action upon the fat splitting enzyme of the pancreas.

With regard to lecithin, we have already given the phosphorus corresponding to the lecithin, but following our previous procedure we now give the percentage of lecithin in the total fat.

—	Fore Period.	F.A. Period.	After Period.
Lecithin in grammes of 100 grammes fat	21·15	7·25	24·77

In this case the effect on the lecithin excretion is most marked. We are inclined to ascribe this decrease and that which took place in the other cases to formic aldehyde having exerted a stimulating effect upon the lecithin splitting ferment of the pancreas, which according to Bokai[1] splits up lecithin into glycero-phosphoric acid, free fatty acids and cholin. That the decreased excretion of lecithin is not due to a retention of lecithin in the body by a direct aborption of it as such, may be concluded from the phosphorus balance.

On referring to the chief table, we see that the *quantity of urine* in this case was increased, in the formic aldehyde period, an exactly opposite effect to that observed elsewhere. The specific gravity of the urine fell during this period. With regard to the excretion of *uric acid*, also an opposite effect was produced, viz., an increase. As in the after period the average uric acid figure fell below the fore period level, we infer that either a dissolving out of uric acid from the tissues took place under formic aldehyde, or a stimulated production of it. The *total sulphuric acid* excretion was somewhat increased both during the formic aldehyde and the after periods; this together with a slightly increased total nitrogen excretion, suggest an effect upon general proteid katabolism in the inverse sense to that observed in Child A. The decrease in *ethereal sulphuric* acid is too small to enable us to draw any conclusions other than negative ones from it. The indoxyl test remained constant through the whole observation. During the formic aldehyde and the after period the *body weight* increased, and this cannot be explained in this case, as in the preceding ones, by a retention of water in the body. This latter occurrence, together with the fact that the general health of the child remained unaffected during the formic aldehyde period, must tend to minimise any adverse deductions which may be made from the above results.

These observations may be summarised in tabular form as follows :—

TABLE IVA.

—	Nitrogen Assimilation %	% N. of Fæces.	Phosphorus Assimilation %	% P. in dry Fæces.	Fat Assimilation %	% Fat in dry Fæces.	$\frac{A}{B}$*	$\frac{N}{SO_3}$**
Fore Period	91·88	6·4	78·28	2·1	95·46	21·1	12·0	6·1
Formic Aldehyde Period	89·01	5·7	61·39	2·2	91·75	22·9	14·5	6·1
After Period	90·27	6·2	50·16	3·7	95·37	17·7	15·8	6·1

* $\frac{A}{B} = \frac{\text{Inorganic } SO_3}{\text{Ethereal } SO_3}$.

** $\frac{N}{SO_3} = \frac{\text{Nitrogen of Urine}}{SO_3 \text{ of Urine}}$, measuring the degree of proteid metabolism.

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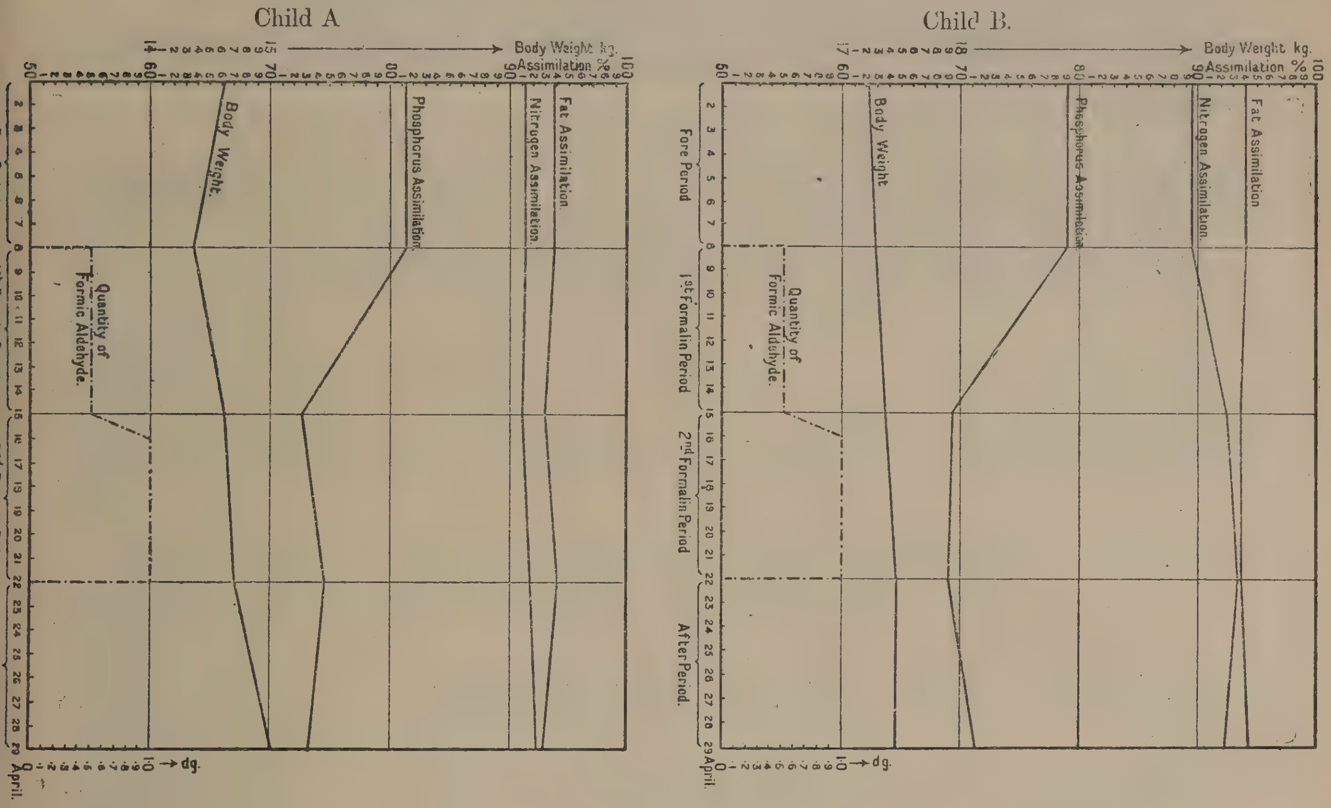
[1] Zeitschr. f. physiol. Chem., 1877, i., p. 162.

Before proceeding to draw our general conclusions, for the sake of reference, we give in one diagram the results of the three observations expressed graphically, as far as regards the influence of formic aldehyde upon nitrogen, phosphorus, and fat assimilation, and body weight.

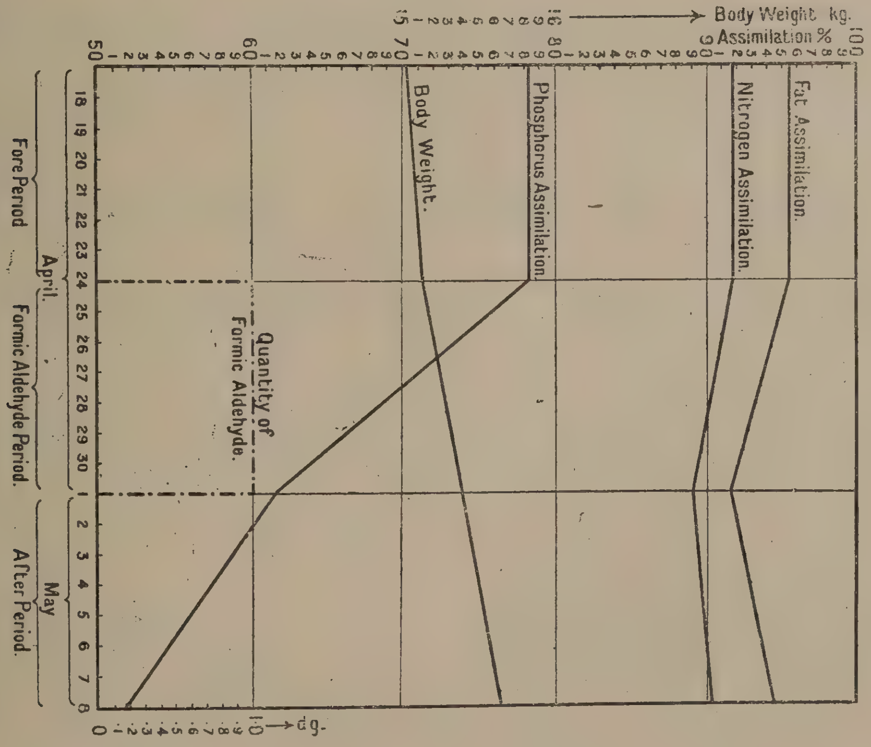
Curve VIII.

howing the influence of formic aldehyde upon the body weight and upon the nitrogen, phosphorus, and fat assimilation of three children.


Child A

Child B.

Child C.



Appendix.

General Conclusions.

(1.) In healthy children formic aldehyde administered with the food in doses up to 1 : 5,000 in milk or 1 : 9,000 in total food and drink exerted no appreciable effect on the nitrogen or phosphorus metabolism, or fat assimilation.

The analytical figures suggest, however, that formic aldehyde has a tendency to diminish phosphorus and fat assimilation, and hence it may be inferred that in larger doses, or if continued for a longer period, it would act in this direction. This effect is referable to an influence upon pancreatic digestion.

(2.) In healthy children formic aldehyde in the above doses produces a retention of water in the body.

(3.) In a delicate child formic aldehyde in the above maximum dose had a chemically measurable deleterious effect upon the nitrogen, phosphorus and fat assimilation, again referable to an action upon the pancreatic digestion, combined with a slight intestinal irritant action. There was a slight tendency to stimulate the katabolism of proteid material.

(4.) In a delicate child formic aldehyde increased the volume of urine and the weight of fæces.

(5.) In all cases the excretion of lecithin in the fæces was diminished under the influence of formic aldehyde. This effect is probably referable to a stimulating action of formic aldehyde on the lecithin-splitting ferment of the pancreas.

(6.) In no instance did formic aldehyde exert any appreciable intestinal antiseptic action.

(7.) In no instance was there any influence on the general health or well-being of the children.

APPENDIX No. VII. (*c*).

REPORT ON THE INFLUENCE OF BORIC ACID AND BORAX UPON THE GENERAL METABOLISM OF CHILDREN; HANDED IN BY PROFESSOR TUNNICLIFFE, BEING A SERIES OF OBSERVATIONS MADE BY HIM IN CONJUNCTION WITH DR. OTTO ROSENHEIM.

Both boric acid and borax are extensively used as food preservatives, and much interest attaches to the question of their influence, if any, upon the general nutrition of the consumer, especially children. Although this method of preserving food has existed for a comparatively long period, there seems no agreement as to the harmfulness or otherwise of these substances when taken with a mixed diet.

The method most valuable for affording us reliable data upon which to base conclusions in this connection is that of comparative metabolic observations on the human subject, extending over a considerable period, and this method we have adopted.

Before entering fully into our own work in this direction, we shall briefly criticise the data from which up to the present the conclusions concerning the harmfulness or otherwise of boric acid and borax as food preservatives have been based.

Literature.—The literature may be summarised as consisting of (I.) experiments made on the influence of these substances upon digestions *in vitro*; (II.) experiments made on animals as to the effect of prolonged small doses upon their general health and metabolism; (III.) general action on man, and one metabolic experiment made on one man.

I. Experiments made upon the influence of boric acid and borax upon digestions *in vitro*.

Comparative qualitative experiments have been carried out in this connection by Hehner[1], Weber[2], F. J. Allen[3], Cripps[4], Leffmann[5], Liebreich[6], Halliburton[7]. Quantitative experiments have also been made by Chittenden[8], Maybery and Goldsmith[9], Rideal and Foulerton[10], and Liebreich[11].

The outcome of the quantitative experiments, which confirm the qualitative ones, may shortly be summarised as follows:—

Salivary Digestion.—Borid acid favours the amylolitic action of saliva (Chittenden). Borax, on the other hand, has an inhibitory action on the conversion of starch by saliva (Weber, Chittenden, Rideal and Foulerton, Liebreich). This latter effect is shown by Liebreich to be an alkali action.

Rennet Action.—Boric acid either has no influence upon the action of rennet upon milk (Cripps, Halliburton) or hastens it (F. J. Allen). Borax, according to the concentration, delays or prevents rennet action (F. J. Allen, Halliburton). By the addition of small quantities of calcium chloride, however, the rennet action takes place in the presence of borax (Allen). It is interesting in this connection to note that sodium chloride has the same action as borax[12].

Gastric Digestion.—Boric acid in large doses favours gastric proteolysis[13] (Chittenden). Borax in small doses has also a slight stimulating action (Chittenden, Rideal and Foulerton), whilst in large doses, proportionally to the increasing alkalinity, it has a retarding effect (Chittenden).

Pancreatic Digestion.—(a) Proteolysis. Borax in small and large doses, proportionately to its concentration, stimulates markedly pancreatic proteolysis (Chittenden). Boric acid (and boric mixture) have a distinct inhibitory action. (b) Amylolysis. Borax mixture exerts a retarding action on the conversion of starch by commercial pancreatic extract (Rideal and Foulerton). Borax itself has a slight retarding action, whilst boric acid has no action (Liebreich).

The results of the above observers seem to justify the conclusion that (the radicle of) boric acid and borax as such exerts no specific action, the effect in each case being referable to the acid, or alkali moiety, all digestions taking place in an acid medium being inhibited by borax, those occurring in an alkaline medium by boric acid.

II. *Experiments made upon Animals.*—(a) Effect of prolonged small doses. Animals have been fed for different periods with food containing various quantities of borax and boric acid by several observers—(Neumann[14], Annett[15], Rideal[16], Liebreich[17]). The outcome of these experiments is shortly that boric acid and borax given in small doses for prolonged periods has no influence on the general health of animals (Neumann, Rideal, Liebreich).

Excessive doses (10 grammes or more, according to body weight) produced transient nausea and vomiting.

To elucidate the question of the effect of boric acid upon young animals[18] a series of experiments were made upon young sucking pigs by A. D. Hall and H. S. Hammond, in collaboration with ourselves, at the South-Eastern Agricultural College, Wye. These observations* show that 0·2 to 2·4 grammes boric acid per diem, continued for seven weeks, added to a mixed weighed diet, had no influence upon the live weight, growth, and general health of the animals.

(b) Metabolic experiments on animals have been made by Cyon[19], Gruber[20], Chittenden and Gies[21], and Liebreich[22]

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[1] Analyst, 1891, p. 126.

[2] Journal Americ. Chem. Soc., 1892, p. 4.

[3] Lancet, 1896 (i.), p. 1516.

[4] Analyst, 1897, xxii., p. 182.

[5] Journ. Franklin Inst., 1899, p. 103.

[6] Vierteljahrschr. gerichtl. Medicin, 1900, p. 83.

[7] Brit. Med. Journ., 1900, ii., 1.

[8] Dietetic and Hygienic Gazette, 1893, p. 25.

[9] Journ Amer. Chem. Soc., 1897, p. 889.

[10] Public Health, 1899, No. 3, p. 554.

[11] Loc. cit.

[12] Ringer, Journ. of Physiol. 1895, p. 425.

[13] Maybery and Goldsmith's results, apparently in conflict with the above statement, are, however, vitiated by the variation in their control experiments.

[14] Arch. f. exp. Path., ii. Pharm., 1881, p. 149.

[15] Lancet, 1899, ii., p. 1282.

[16] Lancet, 1900, i., p. 228.

[17] Loc. cit.

[18] The experiments of Annett (loc. cit.) in this regard cannot be considered conclusive. *Vide* Liebreich (Lancet, 1900, i., 13) and Rideal (loc. cit.).

[19] Comptes rendus, 1878, T. lxxxvii., p. 848.

[20] Zeitschr. f. Biologie, 1880, p. 193.

[21] American Journ. of Physiol., 1898, p. 1.

[22] Loc. cit.

* These observations will be published in extenso elsewhere.

Appendix.

Chittenden and Gies's experiments are very complete and accurate, and in their paper will be found a detailed criticism of the earlier less complete work. The chief conclusions from Chittenden and Gies's work are best given in their own words shortly as follows :—

Moderate doses of borax up to 5 grammes per day, when continued for some time, are without influence upon proteid metabolism and do not exert any general nutritional changes of the body. Large doses of borax, 5–10 grammes daily, have a direct stimulating effect upon proteid metabolism. They tend to retard somewhat the assimilation of proteid and fatty foods, increasing notably the weight of the fæces and their contents of nitrogen and fat.

Boric acid in doses up to 3 grammes per day is practically without influence upon proteid metabolism and general nutrition.

Neither boric acid nor borax affects intestinal putrefaction.

Liebriech's experiment with borax on a dog confirmed Chittenden and Gies's results.

III. *General action on Man, &c.*

There is abundant evidence that boric acid and borax can be taken by man in considerable doses over long periods in the food or by itself, without producing any toxic effect.[1] It is also, however, definitely established that in certain patients medicinal doses (1 gramme two or three times a day) give rise to transient erythematous eruptions after relatively short periods. It is, however, to be noted that these eruptions were, so far as we are aware, invariably produced by the use of boric acid or borax as a drug, no case being reported of the occurrence of rashes caused by these substances in food. How far these rashes depend on idiosyncrasy and are comparable to those produced by shell-fish, strawberries, &c., is outside our purpose to discuss here.

The only metabolic experiment made on man published up till now is one by Forster.[2] The action of boric acid alone on one man was examined. Two relatively short series of experiments were made. In the first 3 grammes of boric acid were given daily for three days with a mixed diet. The second experiment consisted of two periods of two days each in which the subject, an adult man, took 1·5 and 0·5 grammes of boric acid per diem respectively with a milk diet. Forster's conclusions, which appear to have been much more cautiously expressed by himself than by his abstractors, are that boric acid has no influence on proteid metabolism and fat assimilation. He found, however, that the total quantity of fæces and their nitrogen and phosphorous percentage were slightly increased. Forster is inclined to ascribe this to a slightly diminished assimilation, together with an increased epithelial and mucuous excretion from the intestine. (This latter, however, he regards as being purely hypothetical.) He also concludes that boric acid may possibly exert an intestinal antiseptic action, as indicated by the slight decrease of the ethereal sulphates in the urine.

Lehmann, in his "Methoden der prakt. Hygiene, 1901," states that the results of an observation made under his direction by K. Mann upon the latter's own metabolism (not yet published) did not confirm those of Forster.

GENERAL ARRANGEMENT AND METHOD OF OUR OBSERVATIONS.

Before entering into the details especially relevant to our own observations it might be well to recapitulate briefly the general principles of metabolic experiments. They consist in the exact estimation of the quantity of food and its various constituents during a given period and the estimation during the same period of the total excreta and their constituents, chiefly with regard to nitrogen, phosphorus, fat, &c. By this means we get valuable information with regard to the assimilation of these substances by, and their retention in the body. We should like to point out, however, that there is a slight fallacy in this reasoning, in that our knowledge of the origin of fæcal nitrogen is somewhat limited. According to Praussnitz,[3] the whole of the nitrogen in the fæces arises not from the unabsorbed nitrogen of the food, but from the intestinal secretion (epithelial cells, &c.). The value of the metabolic method is not to any extent affected by this, in so far as all nitrogen excreted by the fæces must be regarded as lost to the body, and its subtraction from the quantity of nitrogen ingested gives us the quantity of nitrogen retained. It must, however, be observed at once, as has been emphasized by Pawlow,[4] that the results of these experiments give us no absolute information with regard to the actual digestibility of any given food, in so far as we are left by them in complete ignorance of the amount of energy spent by the organism in producing the observed effect. Provided the organism is equal to the occasion an indigestible food might be as well assimilated and retained as a digestible one, but to produce this result an additional output of energy would be required. If this additional output of energy were relatively small we should probably have no indications with regard to it; but were it relatively large, or, in other words, were the difference in the digestibility of the foods in question great, we should probably find that the body weight or the general health of the person under observation would be affected, and this effect would be the more noticeable the longer the period of observation, and the more sensitive the person chosen. On general principles, we thought it advisable to allow, from these reasons, our observations to extend over comparatively long periods, and to take what were *a priori* to be regarded as relatively sensitive re-agents—viz., children both robust and delicate, and to observe minutely during the various periods their general health and behaviour. From another standpoint children had, in this connection, an additional interest, on account of the fact that milk forms so large proportion of their diet, and it is to milk that boric acid and borax, as preservatives, are generally added.

Our observations were made upon three children, two of whom (boys) might be regarded as typically healthy, and were aged 2½ and 5 years, the third child (girl aged 4 years) was delicate, being convalescent from pneumonia. We shall refer to the children subsequently as A. B. and C. respectively. During the whole period the children were under our perpetual observation, and absolute control was kept over all ingesta, which were accurately weighed by us, and excreta which were collected in diurnal periods without loss. The general conditions of their life remained constant; they were kept for some time before the "fore period" of the observation began under identical conditions to those obtaining during the observation; they took each day the same amount of exercise, and their habits were in every respect regular. The research was carried out during the months of May and June, and extended in the case of B and C over a period of twenty-two days, in the case of A over one of twenty-five days. Each period was sub-divided into four: a fore, a boric acid, a borax, and an after period. The relative lengths of these periods will be seen from the tables. The children had a mixed diet. With regard to the quantities of the different food stuffs we were guided at first by the work of Camerer.[5] This was subsequently modified to a small extent by our own observations concerning the establishment of nitrogenous equilibrium in which the children were approximately placed before the fore period began. Every article of food was carefully analysed, with regard to its percentage composition, and in no case were so-called average figures taken.

In order to minimise the amount of analytical work entailed by this method the three children were supplied from the same stock of foods, which were taken originally in as large a quantity as was consistent with their keeping properties. To this end Pasteurised milk was supplied to us in bottles, each lot of bottles being taken from the same churn.[6] Each lot of meat lasted for about four days, lean beef was usually taken, and the whole stock minced; a sample of this was then analysed.

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[1] R. Virchow, Berl. klin. Wochenschr. No. 1, 1884, Gaucher, Bull. Med., 1890 No. 46 (quoted from Lehmann, Die Methoden der prakt. Hygiene, Wiesbaden, 1901, p. 305), amongst many others.

[2] Arch. f. Hygiene, 1884, p. 75.

[3] Zeitschr. für Biologie, 1897, p. 287.

[4] Die Arbeit der Verduaungsdrüsen, Wiesbaden, 1898.

[5] Der Stoffwechsel des Kindes, Tübingen, 1896.

[6] For this we are indebted to Mr. Droop Richmond of the Aylesbury Dairy Company.

The following table shows the percentage composition of the foods used :—

TABLE I. showing the Percentage Composition of the Foods.

—	Specific Gravity.	Water %	Fat %	Total Carbohydrates %	Nitrogen %	Phosphoric Acid %	Ash %
				Lactose.			
Milk I.	1·0310	88·65	3·00	4·61	0·52	0·23	0·69
„ II.	1·0310	86·63	4.20	4·60	0·53	0·27	0·69
„ III.	1·0330	87.61	3·10	4·94	0·56	0·27	0·72
				Dextrose.			
Bread I.	—	37·90	0·14	55·97	1·20	0·16	0·79
„ II.	—	37·90	0·13	55·97	1·20	0·16	0·79
„ III.	—	36·90	0·18	58·02	1·13	0·15	0·48
				Lactose.			
Butter I.	—	12·68	86.00	0·14	0·11	—	0·50
„ II.	—	14.56	84.37	0·29	0·08	—	0·29
„ III.	—	12.43	85 69	0·16	0·19	—	0·51
				Dextrose.			
Meat I.	—	72·85	2·58	—	3·88	0 45	1·16
„ II.	—	69·22	10·23	—	3·12	0·42	1·08
„ III.	—	73·70	2.93	—	3·33	0·43	1·17
„ IV.	—	73·91	2·74	—	3·34	0·39	1·14
				Dextrose.			
Apple Compote I.	—	63·02	—	29·84	0·06	0·04	0·33
„ „ II.	—	75·80	—	21·80	0·05	0·04	0·34
„ „ III.	—	63·18	—	31·08	0·13	0·06	0·43
				Dextrose.			
Toffee	—	3·14	4·33	76·95	0·03	—	—

The excreta were collected without loss in twenty-four hour periods from 8 a.m. to 8 a.m., and worked up the same day. The fæces were weighed in their normal state each day, small quantities of acid added when necessary, and subsequently evaporated on a water-bath. When dry they were finely powdered and analysed. The fæces belonging to each period were separated by means of the administration of powdered charcoal.

Methods of Analysis.—All nitrogen estimations were made by Gunning's[1] modification of Kjeldahl's method. It was found advantageous, especially in the analysis of the fæces, to add a few crystals of copper sulphate to the mixture of sulphuric acid and potassium sulphate, as by this means a very rapid and quiet oxidation was obtained. Two methods of *phosphorus* estimation were used. In food, fæces, and urine the total phosphorus was estimated by Neumann-Keller's method[2]—viz., by oxidation in a Kjeldahl's flask by means of nitric acid and ammonium nitrate, subsequent precipitation with molybdic solution, &c., and weighing as magnesium pyrophosphate. For the estimation of lecithin phosphorus in the ethereal extract of the fæces the usual process was used (oxidation by means of a mixture of sodium corbonate and nitrate), and subsequent estimation of the phosphorus as before. The carbohydrates were estimated gravimetrically as dextrose or lactose by means of Fehling's solution. *The fats*, which term includes all the ether soluble substances, were estimated by extraction in Soxhlet's apparatus, after previous treatment with alcohol, according to E. V. Voit.[3] *Lecithin* was estimated by multiplying the phosphorus figure obtained from the filtered ethereal extract of the fæces with the factor 7·27, corresponding to distearyl-lecithin. The *Uric acid* was determined by our own modification of Hopkin's method.[4] The total and ethereal sulphuric acids were estimated according to Baumann's method.[5]

Observation I. Child A.

The child was a healthy boy, aged 2½ years, weighed 15·3 kilos, and remained in good health during the whole observation. He consumed daily as follows :—200 grammes of bread, 550 cc. of milk, 20 grammes of butter, 30 grammes of meat, 50 grammes of apple compote, 10 grammes of sugar, 50 cc. of water, and 5 grammes of toffee. This diet was well taken and adhered to throughout the experiment. The whole observation extended over twenty-five days, eight days being taken as a fore period, and five days as an after period. The intermediate period of twelve days consisted of a boric acid period of seven days and a borax period of five days. The pure substances—boric acid or borax, as the case may be—were added to 500 cc. of the daily milk early in the morning, and were administered as shown in the following table :—

Boric Acid Period.

3 days : 0·5 g. per diem = 1 : 1000 in Milk = 1 : 1800 in total Food and Drink.
3 days : 0·66 g. „ = 1 : 760 „ = 1 : 1370 „ „ „
1 day : 1 g. „ = 1 : 500 „ = 1 : 900 „ „ „

Borax Period.

5 days : 1·5 g. per diem = 1 : 330 in Milk = 1 : 600 in total Food and Drink.

It may be noted here that the maximum medicinal dose for this child would be 0·2 g. of boric acid and 0·27 g. of borax, also that the quantities given are greatly in excess of those required for the preservation of milk.[6]

The analytical results obtained throughout the observation are recorded in the following table :—

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[1] Zeitschr. für analyt. Chemie, 1899, p. 89. [2] Zeitschr. für Physiol. Chemie, xxix., p. 151.
[3] Zeitschr. für Biol., xxvii., p. 555.
[4] Centralbl. f. Physiol., 1897, p. 434. It has been shown by the most recent workers that the initial precipitation of uric acid by means of ammonium chloride is just as reliable as the more complicated method of Salkowski Ludwig when certain conditions are observed. Ritter. Folin, Wörner, etc.
[5] Zeitschr. f. Physiol., Chem., i., p. 70. See also Neubauer and Vogel, Analyse des Harns p. 724.
[6] *Vide* Droop Richmond and Harrison, Analysts, 1900, p. 116.

Appendix.

TABLE II.

Showing the INFLUENCE of BORIC ACID and BORAX

PERIOD.	—	Date.	Dose.	URINE.						
				Quantity.	Reaction.	Specific Gravity.	Total Sulphuric Acid.	Ethereal Sulphuric Acid.	Uric Acid.	Nitrogen.
FORE PERIOD.		9 V.		240	Amphoteric.	1·0290	0·6875	0·0322	0·1350	4·52
		10 „		310	Acid.	1·0268	0·8841	0·0415	0·1744	5·42
		11 „		345	Amphoteric.	1·0230	0·9839	0·0462	0·1941	5·15
		12 „		445	„	1·0195	1·2691	0·0596	0 2503	5·59
		13 „		440	Acid.	1·0180	1·2551	0·0590	0·2475	5·13
		14 „		325	„	1·0235	0·9373	0·0442	0·0683	4·95
		15 „		285	Amphoteric.	1·0226	0·8220	0·0388	0·0599	4·21
		16 „		245	„	1·0238	0·7066	0·0333	0·0515	4·11
	Total	8 days.		2,635			7·5426	0·3548	1·1810	39 08
	Average	1 *day.*		*325*		*1·0233*	*0·9428*	*0·0444*	*0·1476*	*4·88*
BORIC ACID PERIOD.		17 V.	0·50	360	Amphoteric.	1·0210	1·0123	0·0561	0·1728	4·91
		18 „	0·50	315	„	1·0258	0·9064	0·0491	0·1512	5·16
		19 „	0·50	300	„	1 0228	0·8436	0·0468	0·1440	4·85
		20 „	0·66	425	„	1·0205	1·1957	0·0663	0·2040	5·69
		21 „	0·66	360	„	1·0196	1·0123	0·0561	0·1728	4·01
		22 „	0·66	410	„	1·0205	1·0953	0·0558	0·2091	6 79
		23 „	1·00	430	„	1·0230	1·1489	0·0584	0·2193	6·75
	Total	7 days.	4·48	2,600			7·2145	0·3886	1·2732	37·86
	Average	1 *day.*	*0·64*	*370*		*1·0218*	*1·0306*	*0·0555*	*0·1819*	*5·41*
BORAX PERIOD.		24 V.	1·5	350	Acid.	1·0228	0·9240	0·0574	0·1733	5·17
		25 „	1·5	320	„	1·0235	0·8448	0·0529	1·1585	5·00
		26 „	1·5	300		1·0225	0·7920	0·0492	0·1485	4·52
		27 „	1·5	450		1·0192	1·1188	0·0738	0·2228	4·12
		28 „	1·5	270	„	1·0263	0·7128	0·0443	0·1337	4·31
	Total	5 days.	7·5	1 690			4·3924	0·2776	0·8367	23·12
	Average	1 *day.*	1·5	*338*		*1·0228*	*0·8785*	*0·0555*	*0·1673*	*4·62*
AFTER PERIOD.		29 V.		355	Acid.	1·0219	0·8975	0·0497	0·1438	5·01
		30 „		335	„	1·0228	0·8469	0·0469	0·1357	4·95
		31 „		570	„	1·0188	1·4410	0·0798	0·2308	7·10
		1 VI.		435	„	1·0165	1·0996	0·0609	0·1762	4·86
		2 „		450	„	1·0205	1·1376	0·0630	0·1823	5·55
	Total	5 days.		2,145			5·4226	0·3003	0·8698	27·47
	Average	1 *day.*		*429*		*1·0201*	*1·0845*	*0·0600*	*0·1737*	*5·49*

TABLE II.

upon the GENERAL METABOLISM of CHILD A, aged 2½ years.

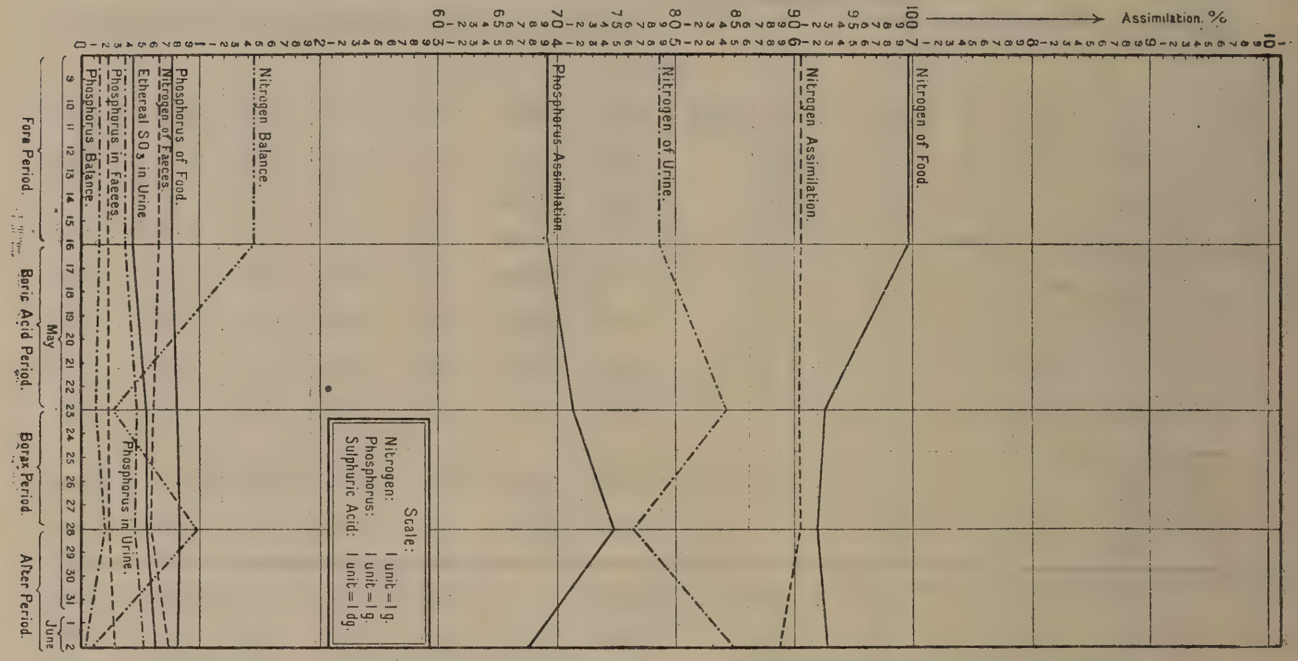
FÆCES.				Nitrogen of Food.	Balance.	Body Weight.	PHOSPHORUS.				FAT.		
Moist.	Dry.	Water %	Nitrogen.				Urine.	Fæces.	Food.	Balance.	Fæces.	Food.	Balance.
11	1·9	82·7	0·11	7·03	+ 2·40	15·28	0·2765	0·0455	0·76	+0·44	0·42	35·57	+ 35·15
88	14·5	83·5	0·86	7·17	+ 0·89		0·3571	0·3472	0·76	+0·06	3·23	35·57	+ 32·34
17	2·7	84·1	0·16	7·17	+ 1·86		0·3974	0·0647	0·76	+0·30	0·60	35·57	+ ·97
114	18·0	76·0	0·06	7·17	+ 0·42		0·5126	0·4310	0·76	−0·18	4·01	34·96	+ 30·95
65	9·9	84·8	0·59	7·23	+ 1·51		0·5069	0·2371	0·76	−0·02	2·21	34·96	+ 32·75
60	7·6	87·3	0·49	7·23	+ 1·79		0·3471	0·1577	0·76	−0·26	1·85	34·96	+ 33·11
47	7·7	83·8	0·50	6·70	+ 1·99		0·3044	0·1598	0·81	+0·35	1·87	35·16	+ 33·29
116	21·4	81·4	1·39	6·28	+ 0·78	15·12	0·2613	0·4441	0·80	+0·09	5·19	37·46	+ 32·27
518	83·7		5·16	55·98	+11·64	*−160g*	2·9633	1·8871	6·17	+1·34	19·38	284·21	+264·83
56	*10·5*	*84·0*	*0·65*	*6·99*	*+ 1·45*	*Loss −23g*	*0·3704*	*0·2359*	*0·77*	*+0·17*	*2·42*	*35·53*	*+ 33·10*
—	—	—	—	6·30	+ 0·39	15·12	0·4784	—	0·80	+0·32	—	37·46	+ 37·46
83	14·9	82·0	0·84	6·30	+ 0·30		0·3818	0·3144	0·80	+0·10	3·60	37·46	+ 33 86
35	8·9	76·0	0·47	6·30	− 0·98		0·3636	0·1772	0·80	+0·26	2·03	37·46	+ 35·43
95	17·9	81·2	1·01	6·30	+ 0·40		0·5151	0·3777	0·80	+0 09	4·32	37·46	+ 33·14
—	—	—	—	6·30	− 2·29		0·4784	—	0·80	+0·32	—	37·46	+ 37·46
60	13·4	77·7	0·76	6·30	− 0·95		0·4600	0·2827	0·80	+0·06	3·24	37·46	+ 34 22
109	22·2	79·6	1·26	6·21	− 1·80	15·42	0·4833	0·4684	0·81	−0·14	5·37	35·37	+ 30 00
382	76·8		4·34	44·01	1·81	*+300g*	3·1606	1·6204	5·61	+0·83	18·56	260·13	+241·57
54	*10·9*	*80·0*	*0·62*	*6·29*	*+ 0·26*	*Gain +43g*	*0·4515*	*0·2315*	*0·80*	*+0·12*	*2·65*	*37·16*	*+ 34·51*
10	1·5	85.0	0·10	6·21	+ 0·94	15·42	0·4424	0·0338	0·81	+0·33	0·31	35·17	+ 35·06
27	5·2	80·7	0·34	6·25	+ 0·91		0·4045	0·1172	0·81	+0·29	1·08	35·17	+ 34·29
74	12·5	82·1	0·81	6·41	+ 1·08		0·3792	0·2816	0·81	+0·15	2·59	41·42	+ 38·83
61	11·3	80·0	0·73	6·41	+ 1·56		0·5688	0·2546	0·81	−0·01	2·35	41·42	+ 39·07
72	15·0	79·2	0·97	5·71	+ 0·43	15·45	0·3413	0·3370	0·81	+0·13	3·12	41·42	+ 38·30
244	45·5		2·95	30·99	+ 4·92	*+30g*	2·1362	1·0242	4·05	+0·19	9·45	195·00	+185·55
49	*9·1*	*81·4*	*0·59*	*6·20*	*+ 0·98*	*Gain +6g*	*0·4272*	*0·2048*	*0·81*	*+0·18*	*1·89*	*39·00*	*+ 37·11*
—	—	—	—	5·74	+ 0·73	15·45	0·4075	—	0·81	+0·40	—	41·68	+ 41·68
48	11·9	75·2	0·78	6·43	+ 0·70		0·3846	0·2812	0·81	+0·14	2·31	41·68	+ 39·37
80	16·4	79·5	1·07	6·44	− 1·73		0·6544	0·3875	8·00	−0·24	3·18	41·68	+ 38·50
—	—	—	—	6·44	+ 1·58		0·4994	—	8·00	+0·30	—	41·68	+ 41·68
131	27·0	79·4	1·77	6·44	− 0·88	15·45	0·5766	0 6380	8·00	−0·41	5·24	41·68	+ 36·44
259	55·3		3·62	31·49	+ 0·40	*±0*	2·5225	1·3067	4·02	+0·19	10·73	208·40	+197·67
52	*11·0*	*78·6*	*0·72*	*6·29*	*0·08*		*0·5045*	*0·2613*	*0·80*	*+0·04*	*2·14*	*41·68*	*+ 39·53*

Appendix.

The results expressed in the above table are graphically represented in the following curves:—

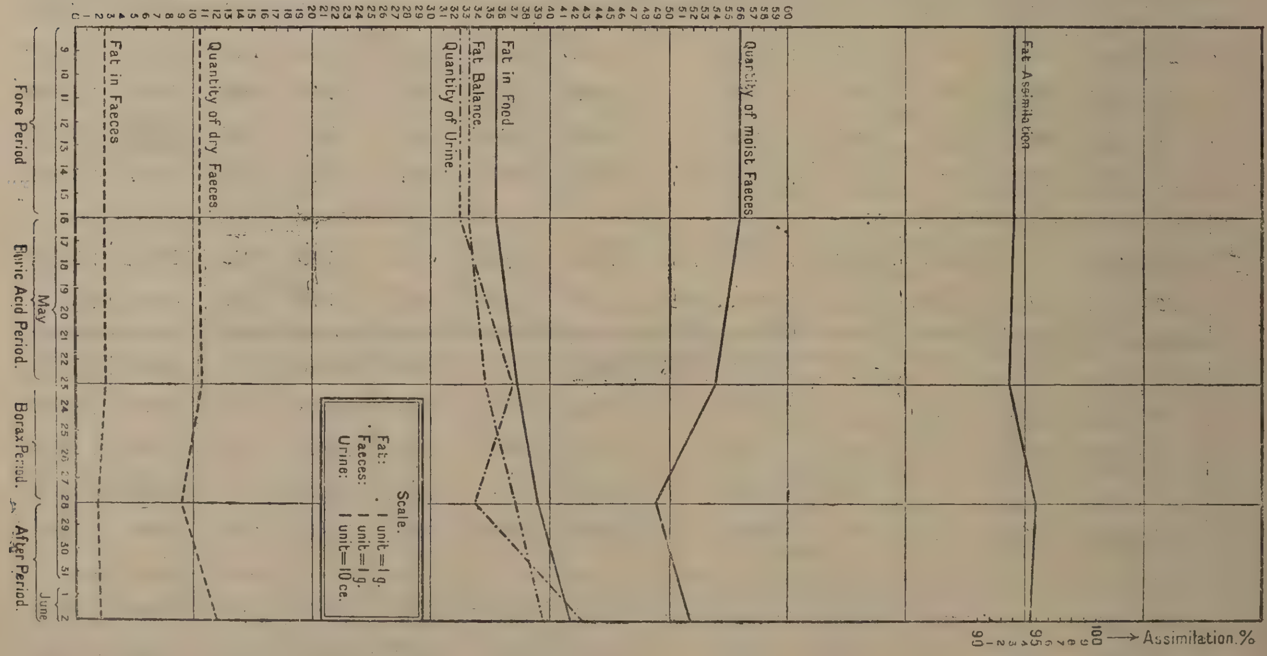
Curve I.

Shewing the influence of boric acid and borax upon nitrogen and phosphorus metabolism, etc.



Curve II.

Showing the influence of boric acid and borax upon fat assimilation and the quantity of fæces and urine.



Appendix.

Referring to the tables and curves relating to Child A, we purpose classifying our remarks under the following headings :—

Nitrogen-Metabolism.

In the fore period the daily quantity of nitrogen taken in the food was 6·99 g., of which 0·65 g. were not assimilated, being lost with the fæces, corresponding to 9·3 %. The assimilation of nitrogen in the fore period amounted therefore to 90·70 %.

With the urine 4·88 g. of nitrogen were excreted, and if this amount be subtracted from the amount assimilated, we obtain a daily balance of + 1·45 g. nitrogen.

To avoid repetition we give the results with regard to the nitrogen balance and assimilation during the different periods in tabular form :—

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Nitrogen in Food - - - - - -	6·99	6·29	6·20	6·29
„ „ Urine - - - - - -	4·88	5·41	4·62	5·49
„ „ Fæces - - - - - -	0·65	0·62	0·59	0·72
Balance - - - - - - -	+1·45	+0·26	+0·98	+0·08
Assimilation % - - - - - - -	90·70	90·14	90·48	88·56
„ % in dry Fæces - - -	6·0	5·7	6·5	6·5

From these results we are justifed in concluding that neither boric acid nor borax exert any influence upon the assimilation of proteids. The tendency of the body to reach nitrogenous equilibrium is clearly shown in the balance figures. From the amount of nitrogen excreted in the urine during the respective periods we may perhaps draw the conclusion that boric acid in this instance tends slightly to increase, and borax slightly to inhibit proteid katabolism.

Phosphorus Metabolism.

The daily average quantity of phosphorus in the food during the fore period was 0·77 g., of which 0·2359 g. were lost, being excreted with the fæces Phosphorus was therefore assimilated to the extent of 69·36%. The relative excretion, etc., of phosphorus in the four periods we give in tabular form.

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Phosphorus in Food - - - - - -	0·77	0·80	0·81	0·80
„ „ Urine - - - - -	0·3704	0·4515	0·4272	0·
„ „ Fæces - - - - -	0·2359	0·2315	0·2048	
Balance - - - - - - -	+0·17	+0·12	+0·18	+0·04
Assimilation % - - - - - - -	69·36	71·06	74·82	67·34
„ in dry Fæces - - -	2·2	2·1	2·2	2·4

These figures show that the phosphorus metabolism was not affected by boric acid and borax. The "assimilation" of phosphorus was, if anything, improved during the drug periods.

Fat Assimilation.

The daily quantity of fat in the food during the fore period was 35·53 grammes. The fat excreted with the fæces was 2·42 grammes. The assimilation therefore amounted to 93·19 %. These results, and those of the following periods are recorded in tabular form as follows :—

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Fat in Food - - - - - - - -	35·53	37·16	39·00	41·68
„ „ Fæces - - - - - - -	2·42	2·65	1·89	2·14
Fat balance - - - - - -	+33·10	+34·51	+37·11	+39·53
Assimilation % - - - - - - -	93·19	92·87	95·19	94·87
Fat in dry Fæces % - - - - - -	23·0	24·3	20·8	19·5

Appendix.

It will be seen from these figures that the amount of fat retained by the body rose with the amount of fat in the food. If anything the assimilation of fat was increased during the borax period.

The chief remaining points of interest brought out by this observation are as follows[1] :—

The *quantity of urine* underwent slight variations during the drug periods in the direction of an increase The increase was more marked during the boric acid period.

The *specific gravity* diminished as the volume increased.

The *reaction*, alternating between acid and amphoteric (litmus) during the fore period, remained constantly amphoteric during the boric acid period, and constantly acid during the borax period.

The *quantity of fæces* remained practically unaltered with the exception of the borax period, in which the average daily quantity is slightly decreased.

The increase in *uric acid* is too slight to permit of any conclusions being drawn from it.

The quantity of total *sulphuric acid* increased slightly in the boric acid period, indicating, with the slight increase of nitrogen in the urine, a tendency to stimulate proteid katabolism.

The *ethereal sulphates* were slightly increased during both periods to an equal extent. Intestinal putrefaction was, therefore, certainly not diminished by either substance, as was also shown by the comparative indoxyl-reactions.

The boric acid could easily be demonstrated in the urine on the first day of its administration, and disappeared completely in the course of the second day of the after period. These results show clearly that both boric acid and borax are rapidly eliminated from the body, and confirm the results of previous workers.[2]

During the boric acid and borax periods the child gained in weight.

The results relevant to the observations made above are summarised in the following table :—

TABLE IIIA.

—	Nitrogen Assimilation, %	% N. of Dry Fæces.	Phosphorus Assimilation, %	% P. of Dry Fæces.	Fat Assimilation, %	% Fat of Dry Fæces.	* $\frac{A}{B}$	** $\frac{N}{SO_3}$
Fore Period - - -	90·70	6·0	69·36	2·2	93·19	23·0	20·2	5·2
Boric Acid Period -	90·14	5·7	71·06	2·1	92·87	24·3	17·6	5·2
Borax Period - -	90·48	6·5	74·82	2·2	95·19	20·8	14·4	5·3
After Period - -	88·56	6·5	67·34	2·4	94·87	19·5	17·1	5·1

* $\frac{A}{B} = \frac{\text{Inorganic } SO_3}{\text{Ethereal } SO_3}$ ** $\frac{N}{SO_3} = \frac{\text{Nitrogen of Urine}}{SO_3 \text{ of Urine}}$ measuring the degree of proteid metabolism.

Observation II. Child B.

The child was a healthy boy, aged five years, weighing 18·5 kilos, and remained in good health during the whole observation. He consumed daily 250 g. of bread, 600 cc. of milk, 20 g. of butter, 50 g. of meat, 50 g. of apple compote, 10 g. of sugar, 50 cc. of water, and 5 g. of toffee. The whole observation lasted for twenty-two days. The fore period in this case lasted for five days, otherwise the arrangement and quantity of boric acid and borax given were the same as in Observation I. These substances were administered as shown in the following table :—

Boric Acid Period.

3 days : 0·5 g. per diem = 1 in 1000 milk, 1 in 2000 total food and drink.

3 days : 0·66 g. „ = 1 in 760 „ 1 in 1500 „ „ „

1 day : 1·0 g. „ = 1 in 500 „ 1 in 1000 „ „ „

Borax Period.

5 days : 1·5 g. per diem = 1 in 330 milk, 1 in 660 total food and drink.

It may be noted here that the maximum medicinal dose for this child is in the case of boric acid 0·24 g., of borax 0·33 g., and that the quantities given, as in the former observation are greatly in excess of those which would be required as a food preservative.

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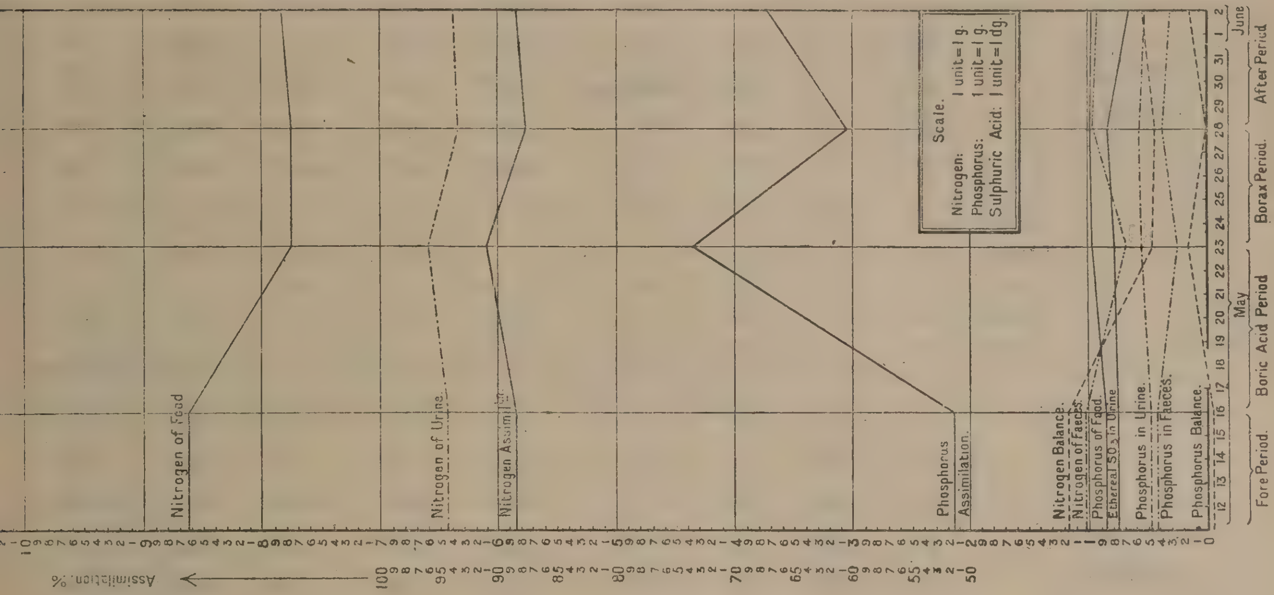
[1] In these remarks throughout the entire paper we refer to the average daily excretion in question.

[2] Chittenden and Gies (loc. cit.), where also references to former observers are given.

The results expressed in the table on pages 344 and 345 are graphically represented in the following curves : —

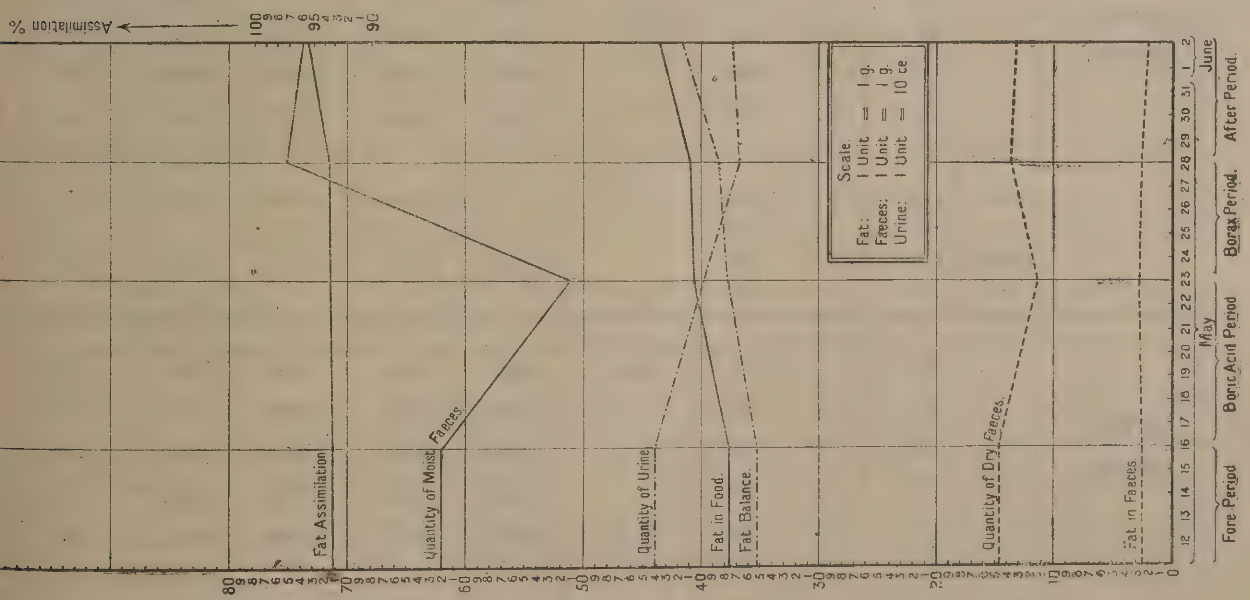
Curve III.

Showing the influence of boric acid and borax upon nitrogen and phosphorus metabolism, &c



Curve IV.

Showing the influence of boric acid and borax upon fat assimilation, and the quantity of fæces and urine.



The analytical results obtained throughout this observation are recorded in the following table —

Appendix.

TABLE III.

Showing the INFLUENCE of BORIC ACID and

PERIOD.	——	Date.	Dose.	URINE.						
				Quantity.	Reaction.	Specific Gravity	Total Sulphuric Acid.	Ethereal Sulphuric Acid.	Euric Acid.	Nitrogen.
FORE PERIOD.		12 V.		510	Acid	1·0194	1·4412	0·0899	0·1035	6·47
		13 ,,		395	,,	1·0240	1·1762	0·0696	0·0802	6·59
		14 ,,		390	Amphoteric	1·0185	1·1020	0·0687	0·0792	4·64
		15 ,,		450	,,	1·0228	1·2715	0·0793	0·0914	7·21
		16 ,,		470	,,	1·0226	1·3281	0·0821	0·0954	7·41
	Total ...	5 days.		2,215			6·3190	0·3896	0·4497	32·32
	Average	*1 day.*		*440*		*1·0214*	*1·2638*	*0·0779*	*0·0899*	*6·46*
BORIC ACID PERIOD.		17 V.	0·50	365	Acid	1·0275	1·1100	0·0744	0·0631	6·66
		18 ,,	0·50	400	,,	1·0266	1·2165	0·0816	0·0692	6·94
		19 ,,	0·50	450	,,	1·0225	1·3685	0·0918	0·0779	6·84
		20 ,,	0·66	305	,,	1·0254	0·9276	0·0622	0·0528	5·26
		21 ,,	0·66	240	,,	1·0175	0·7299	0·0489	0·0415	3·18
		22 ,,	0·66	600	,,	1·0244	1·9629	0·0192	0·2250	10·27
		23 ,,	1·00	430	,,	1·0280	1·4174	0·0783	0·1613	7·16
	Total ...	7 days.	4·48	2,790	,,		8·7328	0·5464	0·6908	46·31
	Average	*1 day.*	*0·64*	*398*		*1·0245*	*1·2475*	*0·0780*	*0·0987*	*6·61*
BORAX PERIOD.		24 V.	1·5	320	Acid	1·0228	1·0496	0·0717	0·0720	6·22
		25 ,,	1·5	410	,,	1·0248	1·3448	0·0918	0·0923	7·23
		26 ,,	1·5	365	,,	1·0255	1·1972	0·0818	0·0821	6·04
		27 ,,	1·5	430	,,	1·0236	1·4104	0·0963	0·0968	6·87
		28 ,,	1·5	300	,,	1·0290	0·9848	0·0672	0·0675	5·38
	Total ...	5 days.	7·5	1,825	,,		5·9860	0·4088	0·4107	31·74
	Average	*1 day.*	*1.5*	*365*		*1·0251*	*1·1972*	*0·0817*	*0·0821*	*6·35*
AFTER PERIOD.		29 V.		395	Acid	1·0195	1·2403	0·0672	0·1185	5·21
		30 ,,		335	,,	1·0282	1·0519	0·0569	0·1005	6·41
		31 ,,		300	,,	1·0300	0·9420	0·0510	0·0900	6·79
		1 ,,		425	,,	1·0232	1·3345	0·0722	0·1275	7·08
		2 ,,		405	,,	1·0215	1·2717	0·0688	0·1215	6·49
	Total ...	5 days.		1,860			5·8404	0·3161	0·5580	31·98
	Average	*1 day.*		*372*		*1·0245*	*1·1681*	*0·0632*	*0·1116*	*6·39*

TABLE III.

BORAX upon the GENERAL METABOLISM of CHILD B.

FÆCES.				Nitrogen of Food.	Balance.	Body Weight.	PHOSPHORUS.				FAT.		
Moist.	Dry.	Water %	Nitrogen.				Urine.	Fæces.	Food.	Balance.	Fæces.	Food.	Balance.
—	—	—	—	8·99	+2·52	18·53	0·5712	—	0·85	+0·28	—	36·98	+31·98
110	27·2	75·3	1·84	9·05	+0·62		0·4527	0·7621	0·85	−0·36	4·68	36·98	+32·30
—	—	—	—	9·05	+4·41		0·4308	—	0·85	+0·42	—	36·98	+36·98
94	22·2	76·4	1·50	8·33	−0·38		0·5040	0·6220	0·85	−0·28	3·82	36·96	+33·14
107	25·2	76·5	1·71	7·78	−1·34	18·36	0·5264	0·7061	0·96	−0·27	4·33	41·05	+36·72
311	74·6		5·05	43·20	+5·83	*−170g.*	2·4851	2·0902	4·36	−0·21	12·83	188·95	+176·12
62	*14·9*	*76·0*	*1·01*	*8·64*	*+1·17*	*−34g.*	*0·4970*	*0·4180*	*0·87*	*−0·04*	*2·56*	*37·59*	*+35·03*
—	—	—	—	7·78	+1·12	18·36	0·4790	—	0·96	+0·48	—	41·05	+41·05
76	16·8	78·9	1·03	7·78	−0·19		0·5136	0·3861	0·96	+0·06	3·91	41·05	+37·14
—	—	—	—	7·78	+0·94		0·5778	—	0·96	+0·38	—	41·05	+41·05
96	20·5	78·6	1·27	7·78	+1·25		0·4002	0·4711	0·96	+0·09	4·77	41·05	+36·28
—	—	—	—	7·78	+4·60		0·3149	—	0·96	+0·65	—	41·05	+41·05
90	20·0	77·8	1·24	7·78	−3·73		0·8616	0·4596	0·96	−0·36	4·67	41·05	+36·38
94	21·1	77·6	1·31	7·72	−0·75	18·75	0·6174	0·4849	0·97	−0·13	4·91	37·50	+32·59
35·6	78·4		4·85	54·42	+3·26	*+390g.*	3·7645	1·8017	6·73	+1·16	18·26	283·80	+265·54
51	*11·2*	*77·8*	*0·69*	*7·77*	*+0·47*	*Gain +56g.*	*0·5378*	*0·2574*	*0·96*	*+0·17*	*2·61*	*40·54*	*+37·93*
—	—	—	—	7·72	+1·50	18·75	0·4932	0·4545	0·97	+0·02	—	37·50	+37·50
—	—	—	—	7·76	+0·53		0·6320	—	0·97	+0·34	—	37·50	+37·50
89	20·8	76·6	1·46	7·95	+0·45		0·5627	0·4545	0·97	−0·05	3·99	43·10	+39·11
55	12·9	76·5	0·91	7·95	+0·17		0·6628	0·2819	0·97	+0·03	2·47	43·10	+40·63
229	34·2	85·1	2·39	7·37	−0·40	18·78	0·4416	0·7472	0·97	−0·22	6·50	43·10	+36·60
373	67.9		4·76	38·75	+2·25	*+30g.*	2·7923	1·9381	4·85	+0·12	12·96	204·30	+191·34
75	*13·6*	*81·3*	*0·95*	*7·75*	*+0·45*	*Gain +6g.*	*0·5584*	*0·3876*	*0·97*	*+0·02*	*2·59*	*40·87*	*+38·27*
—	—		—	7·39	+2·18	18·78	0·5674	—	0·97	+0·40	—	43·36	+43·36
117	24·1		1·65	7·97	−0·09		0·4702	0·5644	0·97	−0·06	3·54	43·36	+39·82
132	13·0		0·89	7·97	+0·29		0·4211	0·3044	0·96	+0·23	1·91	43·27	+41·36
—	—		—	7·97	+0·89		0·5966	—	0·96	+0·36	—	43·27	+43·27
121	29·6		2·04	7·97	−0·56	18·81	0·5685	0·6932	0·96	−0·30	4·34	43·27	+38·93
370	66·7		4·58	39·27	+2·71	*+30g.*	2·6238	1·5620	4·82	+0·64	9·79	216·53	+206·74
74	*13·3*	*82·0*	*0·92*	*7·85*	*+0·54*	*Gain +6g.*	*0·5247*	*0·3214*	*0·96*	*+0·13*	*1·96*	*43·30*	*+41·35*

Appendix.

Adopting the same method as in the previous observation we arrive at the following results :—

Nitrogen Metabolism.

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Nitrogen in Food	8·64	7·77	7·75	7·85
„ „ Urine	6·46	6·61	6·35	6·39
„ „ Fæces	1·01	0·69	0·95	0·92
Balance	+1·17	+0·47	+0·45	+0·54
Assimilation	88·31	91·12	87·74	88·28
Nitrogen % in dry Fæces	6·7	6·1	6·9	6·9

From these figures it will be seen that the nitrogen metabolism underwent no change. The assimilation of the nitrogenous food was improved during the boric acid period, and practically not affected during the borax period. The tendency of the body to reach equilibrium is clearly seen in the balance figures. The variation of the nitrogen in the urine during the respective periods is very small, but may be regarded as pointing to a slight stimulation of proteid katabolism during the borac acid period and the reverse during the borax period.

Phosphorus Metabolism.

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Phosphorus in Food	0·87	0·96	0·97	0·96
„ „ Urine	0·4970	0·5378	0·5584	0·5247
„ „ Fæces	0·4180	0·2574	0·3876	0·3124
Balance	– 0·04	+0·17	+0·02	+0·13
Assimilation %	51·72	73·30	60·04	67·46 %
Phosphorus in dry Fæces %	2·9	2·3	2·8	2·3

From the above figures it will be seen that these drugs did not affect the phosphorus metabolism, but that the assimilation of phosphorus was rather improved by them, especially by boric acid. Taking into consideration the fact that the phosphorus in the food was increased during the drug periods, the slight increase of phosphorus in the urine cannot be regarded as pointing to an increased phosphorus katabolism.

Fat Assimilation.

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Fat in Food	37·59	40·54	40·87	43·30
„ „ Fæces	2·56	2·61	2·59	1·96
Balance	+35·03	+37·93	+38·27	+41·35
Assimilation %	93·19	93·57	93·66	95·47
„ in dry Fæces %	17·2	23·3	19·0	14·7

From the figures in this table it will be seen that the same remarks apply as in Observation I., viz., that boric acie and borax exerted no influence upon fat metabolism.

The remaining points to be considered may, as in the preceding observation, be divided as follows :—

Appendix.

The *quantity of urine* was decidedly diminished during the borax period, to a less extent during the boric aci period. The specific gravity increased with the diminishing volume. The reaction of the urine kept constantly acid to litmus during both the boric acid and borax period. In the fore peried it varied between amphoteric and acid.

Quantity of fæces.—During the boric acid period the quantitity of fæces was slightly decreased.

The *uric acid* variation is too slight to permit of any conclusion being drawn from it. The alteration in the quantity of total *sulphuric acid* during the respective periods was very slight, but in the same direction as that of the total nitrogen. The *ethereal sulphates* underwent no change during the boric acid period, but increased slightly during the borax period. Neither substance exerted therefore any intestinal antiseptic action, the increase during the borax period is probably an alkali effect, the same having been observed in the case of other alkaline salts. Boric acid showed itself in the urine of the first day of its administration, and disappeared completely in the course of the second day of the after period.

The *body weight* increased during the boric acid and borax periods.

The results relevant to the observations made above are summarised in the following table :—

TABLE IIIA.

—	Nitrogen Assimilation %	% N. of Dry Fæces.	Phosphorus Assimilation %	% P. of Dry Fæces.	Fat Assimilation %	% Fat of Dry Fæces.	$\frac{A}{B}$ *	$\frac{N}{SO_3}$
Fore Period - - -	88·31	6·7	51·72	2·9	93·19	17·2	15·2	5·1
Boric Acid Period - -	91·12	6·1	73·30	2·3	93·57	23·33	15·0	5·3
Borax Period - - -	87·74	6·9	60·04	2·8	93·66	19·0	13·7	5·3
After Period - - -	88·28	6·9	67·46	2·3	95·47	14·7	17·5	5·5

* As in Table II.a.

** ,, ,, ,,

Observation III. Child C.

The child was a delicate girl, aged four years, weighing 15·6 kilos. She was convalescent from pneumonia and compared with the other children not so well nourished or developed. She consumed daily 200 g. of bread, 550 cc. of milk, 20 g. of butter, 30 g. of meat, 50 g. of apple compote, 10 g. of sugar, 50 cc. of water, 5 g. of toffee.

The whole observation lasted for twenty-two days, of which five days were devoted to the fore period, seven days to boric acid, five days to borax, and five days to the after period.

The boric acid and borax were administered as shown in the following table :—

Boric Acid Period.

3 days : 0· 5 g. per diem = 1 : 1000 in milk = 1 : 1800 in total food and drink.

3 days : 0·66 g. ,, = 1 : 760 ,, = 1 : 1370 ,, ,, ,,

1 day : 1· 0 g. ,, = 1 : 500 ,, = 1 : 330 ,, ,, ,,

Borax Period.

5 days : 1· 5 g. per diem = 1 : 330 in milk = 1 : 600 in total food and drink.

It may be noted that the maximum medicinal dose for this child is in the case of boric acid 0·24 g., of borax 0·33 g., and that the quantities given, as in the former observations, are greatly in excess of those which would be required as a food preservative.

The analytical results obtained throughout this observation are recorded in the following table :—

Appendix.

TABLE IV.

Showing the influence of Boric Acid and Borax upon

PERIOD.	—	Date.	Dose.	URINE.						
				Quality.	Reaction.	Specific Gravity.	Total Sulphuric Acid.	Ethereal Sulphuric Acid.	Uric Acid.	Nitrogen.
FORE PERIOD.		12 V.		445	Amphoteric	1·0200	1·1861	0·0719	0·1902	5·74
		13 „		400	„	1·0226	1·0671	0·0646	0·1710	5·72
		14 „		480	Acid.	1·0200	1·2805	0·0776	0·2052	6·48
		15 „		350	„	1·0227	0·9337	0·0566	0·1496	5·09
		16 „		275	Amphoteric	1·0270	0·7336	0·0444	0·1176	4·59
	Total -	5 days.		1950			5·2010	0·1151	0·8336	27·62
	Average	*1 day.*		*390*		*1·0224*	*1·0402*	*0·0630*	*0·1667*	*5·52*
BORIC ACID PERIOD.		17 V.	0·50	405	Acid.	1·0200	1·2422	0·0818	0·1124	5·18
		18 „	0·50	320	„	1·0285	0·9816	0·0646	0·0888	5·93
		19 „	0·50	330	„	1·0269	0·8589	0·0667	0·0916	5·46
		20 „	0·66	260	„	1·0275	0·9662	0·0525	0·0722	4·75
		21 „	0·66	310	Amphoteric	1·0260	0·7208	0·0626	0·0860	5·40
		22 „	0·66	2150	„	1·0295	0·8580	0·0590	0.1444	4·91
		23 „	1·00	200	Acid.	1·0255	0·6864	0·0472	0·1155	3·44
	Total -	7 days,	4·48	2075			6·3141	0·4344	0·7109	35·07
	Average	*1 day.*	*0·64*	*296*		*1·0262*	*0·9020*	*0·0620*	*0·1015*	*5·01*
BORAX PERIOD.		24 V.	1·5	355	Acid.	1·0236	1·0438	0·0774	0·2103	5·33
		25 „	1·5	320	„	1·0215	0·9409	0·0698	0·1896	4·39
		26 „	1·5	280	„	1·0260	0·8229	0·0610	0·1659	4·73
		27 „	1·5	315	„	1·0247	0·9267	0·0686	1·1866	4·76
		28 „	1·5	235	„	1·0276	0·6909	0·0512	0·1392	4·29
	Total -	5 days.	7·5	1505			4·4252	0·3280	0·8916	23·50
	Average	*1 day.*	*1·5*	*301*		*1·0247*	*0·8850*	*0·0656*	*0·1783*	*4·70*
AFTER PERIOD.		29 V.		410	Acid.	1·0193	1·1572	0·0683	0·0738	5·51
		30 „		365	„	1·0236	1·0302	0·0608	0·0657	5·76
		31 „		270	„	1·0227	0·7620	0·0450	0·0486	4·53
		1 VI.		415	„	1·0187	1·1713	0·0691	0·0747	5·11
		2 „		295	„	1·0270	0·8326	0·0492	0·0531	5·12
	Total -	5 days		1755			4·9533	0·2924	0·3159	26·03
	Average	*1 day.*		*351*		*1.0222*	*0·9906*	*0·0585*	*0·632*	*5·20*

Appendix.

TABLE IV.

the GENERAL METABOLISM of the invalid Child C.

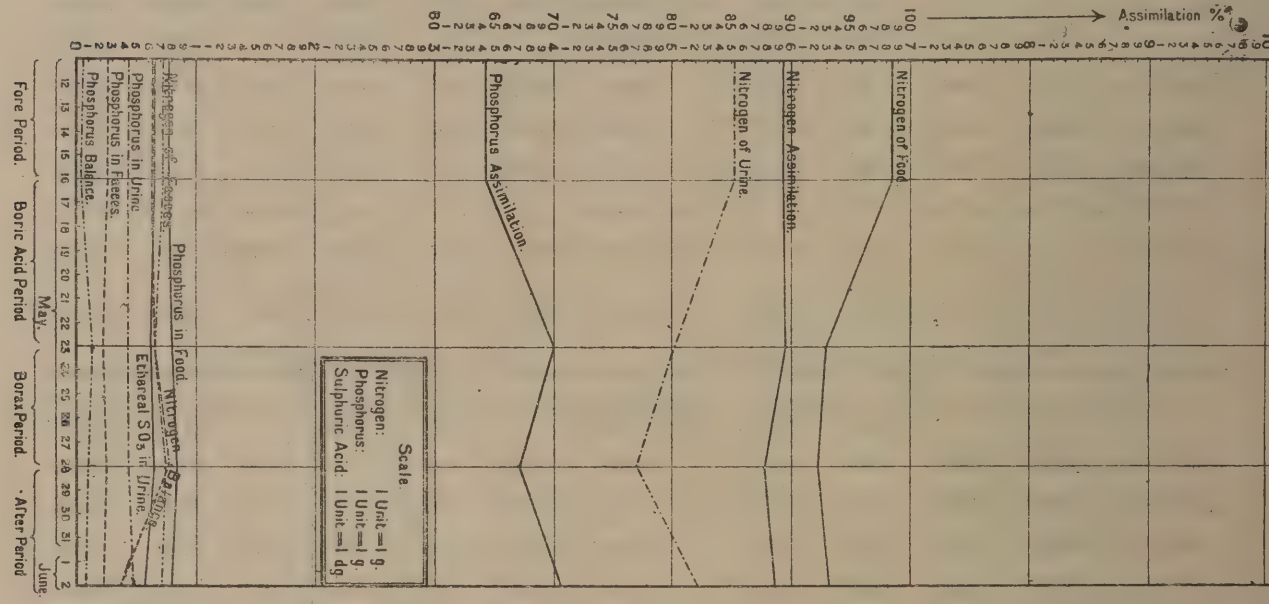
FÆCES.				Nitrogen of Food.	Balance.	Body Weight.	PHOSPHORUS.				FAT.		
Moist.	Dry.	Water %	Nitrogen.				Urine.	Fæces.	Food.	Balance.	Fæces.	Food.	Balance.
26	7·3	71·2	0·46	7·17	+0·91	15·62	0·5020	0·1785	0·76	+0·09	1·50	34·96	+33·46
				7·23	+1·59		0·4512	—	0·76	+0·31		34·96	+34·96
69	15·6	77·4	0·99	7·23	−0·24		0·5414	0·3814	0·76	−0·16	3·21	34·96	+31·75
48	9·6	80·0	0·61	6·46	+0·76		0·3948	0·2347	0·81	+0·18	1·97	35·16	+33·19
109	24·8	77·2	1·57	6·28	+0·12		0·3102	0·5915	0·80	−0·10	5·10	37·46	+32·36
252	57·3		3·63	34·37	+3·12	15·62	2·1996	1·3861	3·89	+0·32	11·78	177·50	+165·72
50	*11·4*	*77·3*	*0·72*	*6·87*	*+0·62*	*+0*	*0·4399*	*0·2772*	*0·78*	*+0·06*	*2·35*	*355·0*	*+33·14*
				6·30	+1·12	15·62	0·5464		0·80	+0·25		37·46	+37·46
165	18·8	88·6	0·94	6·30	−0·57		0·4317	0·4019	0·80	−0·03	3·55	37·46	+33·91
127	11·5	90·9	0·58	6·30	+0·26		0·4453	0·2458	0·80	+0·11	2·17	37·46	+35·29
9	1·6	82·2	0·08	6·30	+1.47		0·4857	0·0342	0·80	+0·28	0·30	37·46	+37·16
112	16·5	85·3	0·82	6·30	+0·08		0·4182	0·3527	0·80	+0·03	3·11	37·46	+34·55
68	12·7	81·3	0·82	6·33	+0·57		6·3350	0·2478	0·80	+0·22	3·05	37·46	+34·41
104	20·6	80·2	1·32	6·21	+1·45	15·84	0·2680	0·4019	0·81	+0·14	4.94	35·37	+30·43
585	81·7		4·56	44·01	+4·38	+*220* *Gain*	2·9303	1·6843	5·61	+1·05	17·12	260·13	+243·01
83	*81·7*	*86·0*	*0·65*	*6·29*	*+0·62*	*+31 g.*	*0·4186*	*0·2406*	*0·80*	*+0·14*	*2·44*	*37·16*	*+34·71*
				6·21	+0·88	15·84	0·4916	—	0·81	+0·32		35·37	+35·37
57	13·7	76·0	0·87	6·25	+0·99	—	0·4431	0·3098	0·81	+0·06	2·90	35·37	+32·47
48	10·6	77·9	0·67	6·41	+1·01	—	0·3878	0·2397	0·81	+0·18	2·25	41·42	+39·17
64	12·8	80·0	0·82	6·41	+0·83	—	0·4362	0·2895	0·81	+0·09	2·71	41·42	+38·71
141	21·6	84·7	1·39	5·84	+0·16	16·06	0·3254	0·4885	0·81	−0·01	4·58	41·42	+36·84
310	58·7		3·75	31·12	+3·87	+*220* *Gain*	2·0841	1·3275	4·05	+0·64	12·44	195·00	+182·56
62	*11·7*	*81·1*	*0·75*	*6·22*	*+0·77*	*+44g.*	*0·4168*	*0·2655*	*0·81*	*+0·13*	*2·48*	*39·00*	*+36·51*
				5·85	+0·34	16·06	0·5406	—	0·81	+0·27		41·68	+41·61
58	11·0	81·0	0·79	6·43	+0·12		0·4814	0·2625	0·81	+0·07	1·96	41·68	+39·72
90	14·6	83·0	1·04	6·44	+0·87		0·3502	0·3448	0·80	+0·10	2·61	41·68	+39·07
61	10·0	83·6	0·72	6·44	+0·61		0·5484	0·2386	0·80	+0·01	1·78	41·68	+39·90
95	14·9	84·3	1·07	6·44	+0·25	16·00	0·3891	0.3555	0·80	+0·06	2·65	41·68	+39·90
304	50·5		3·62	31·69	+1·95	*−60* *Loss.*	2·3097	1·2050	4·02	+0·51	9·00	208·40	+199·40
61	*10·1*	*83·4*	*0·72*	*6·32*	*+0·39*	*12g.*	*0·4619*	*0·2410*	*0·80*	*+0·10*	*1·80*	*51·68*	*+39·88*

Appendix

The results expressed in the above table are represented graphically in the following curves :—

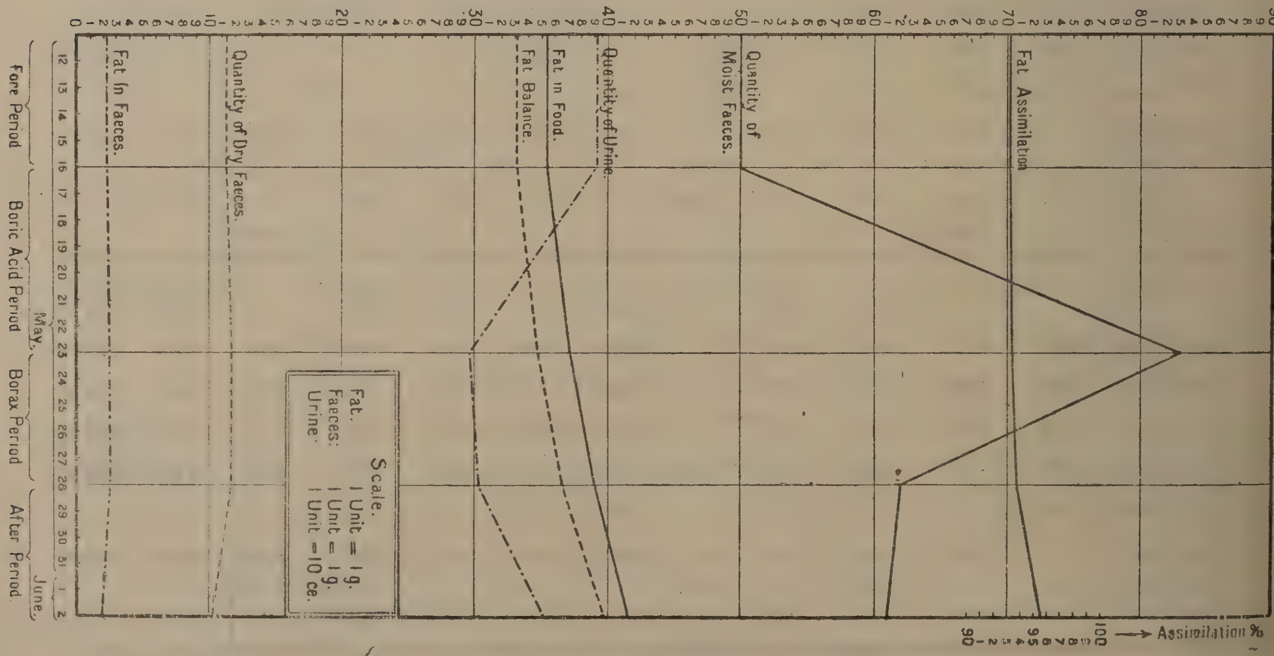
Curve V.

Showing the influence of boric acid and borax upon the nitrogen and phosphorous metabolism of an invalid child.



Curve VI.

Showing the influence of boric acid and borax upon the fat assimilation, and upon the quantity of faeces and urine of an invalid child.



Adopting the same method as in the previous observations we arrive at the following results with regard to

Appendix.

Nitrogen Metabolism.

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Nitrogen in Food	6·87	6·29	6·22	6·32
„ „ Urine	5·52	5·01	4·70	5·20
„ „ Fæces	0·72	0·65	0·75	0·72
Balance	+0·62	+0·62	+0·77	+0·39
Assimilation %	89·52	89·66	87·94	88 61
„ in dry Fæces %	6·3	5·6	6·4	7·0

The assimilation of proteids was in this case not affected by boric acid, but slightly decreased by borax. The balance remained practically constant, being near the equilibrium.

In this case boric acid does not seem to have stimulated proteid katabolism, whilst borax showed its usual inhibitory tendency.

Phosphorus Metabolism.

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Phosphorus in Food	0·78	0 80	0·81	0·80
„ „ Urine	0·4399	0·4186	0·4168	0·4619
„ „ Fæces	0·2772	0·2406	0·2655	0·2410
Balance	+0·06	+0·14	+0·13	+0·10
Assimilation %	64·46	70·00	67·23	69·88
Phosphorus in dry Fæces %	2·4	2·1	2·1	2·3

As in the former cases the phosphorus assimilation was improved, especially in the boric acid period. The katabolism of substances rich in phosphorus seemed to be slightly inhibited in both periods.

Fat Metabolism.

——	Fore Period.	Boric Acid Period.	Borax Period.	After Period.
Fat in Food	35·50	37·16	39.00	41·68
„ „ Fæces	2·35	2·44	2·48	1·80
Balance	+33·14	+34·71	+36·51	+39·88
Assimilation %	93·38	93·43	93·64	95·68
Fat indry Fæces %	20·6	20·8	21·2	17·8

As in the former cases the fat balance increased with the amount of fat ingested. The assimilation of fat was not affected.

The remaining points to be considered may, as in the preceding observations, be classified as follows :—

The *quantity of urine* decreased during the boric acid and borax period to the same extent, the *specific gravity* increasing with the diminishing volume. The reaction varied between acid and amphoteric during the boric acid period, and remained acid throughout the borax period.

The *quantity of dry fæces* underwent no change during the boric acid and borax period.

The *uric acid* excretion decreased somewhat during the boric acid period along with the decrease of nitrogen in food and the decreased nitrogen excretion in urine. During the borax period, however, we observed an increase in the amount of uric acid excreted, although the total nitrogen in the food and urine diminished. This seems to point to a specific uric acid solvent effect on the part of the borax, and not to an increased uric acid formation, as in the after period the uric acid sank considerably below the fore period level.

The somewhat decreased quantity of *total sulphuric acid* excreted during the borax period confirms the

Appendix. conclusion drawn from the decreased nitrogen and phosphorus—namely, that borax tends to slightly inhibit katabolism.

As in the former case, neither substance exerted an intestinal antiseptic action, borax, probably by virtue of its alkalinity, tending to increase the amount of ethereal sulphates eliminated.

Boric acid could be demonstrated in the urine in the first day of its administration, and was completely absent on the second day of the after period.

The body weight increased during both boric acid and borax period.

The results relevant to the observations made above are summarised in the following table :—

TABLE IVA.

——	Nitrogen Assimilation %	% N of dry Fæces.	Phosphorus Assimilation %	% P of dry Fæces.	Fat Assimilation %	% Fat of dry Fæces.	* $\frac{A}{B}$	$\frac{N}{SO^3}$
Fore Period - - -	89·52	6·3	64·46	2·4	93·38	20·6	15·5	5·3
Boric Acid Period- -	89·66	5·6	70·00	2·1	93·43	20·8	18·5	5·5
Borax Period - -	87·94	6·4	67·23	2·1	63·64	2·12	12·5	5·3
After Period - - -	88·61	7·0	69·88	2·3	95·68	17·8	15·9	5·2

$$\left.\begin{array}{l} * \ \frac{A}{B} \\ ** \ \frac{N}{SO_3} \end{array}\right\} \text{as in tube } \mathit{IIa}.$$

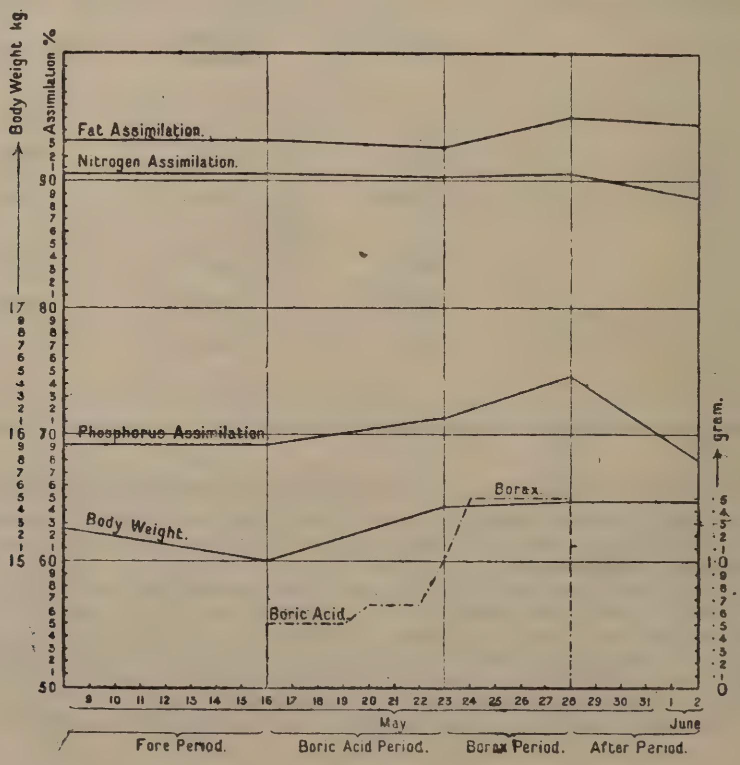
In all the three observations we estimated the amount of *lecithin* in the fæces during the normal and drug periods The result of these investigations together with others will form the subject of a future paper, and we will restrict ourselves here to the simple statement that the excretion of lecithin with the fæces was diminished in each case during the borax periods. This observation, together with the fact of the improved phosphorus assimilation seems to point to a stimulating effect of this drug upon the pancreatic digestion, thus corroborating "in vitro" what has already been shown "in vitro." (Compare Chittenden, loc. cit.)

Before proceeding to draw our general conclusions we give for the sake of reference, in our diagram, the result of the three observations expressed graphically, in so far as regards the influence of boric acid and borax upon nitrogen, phosphorus, and fat assimilation and body-weight.

Curve VII.

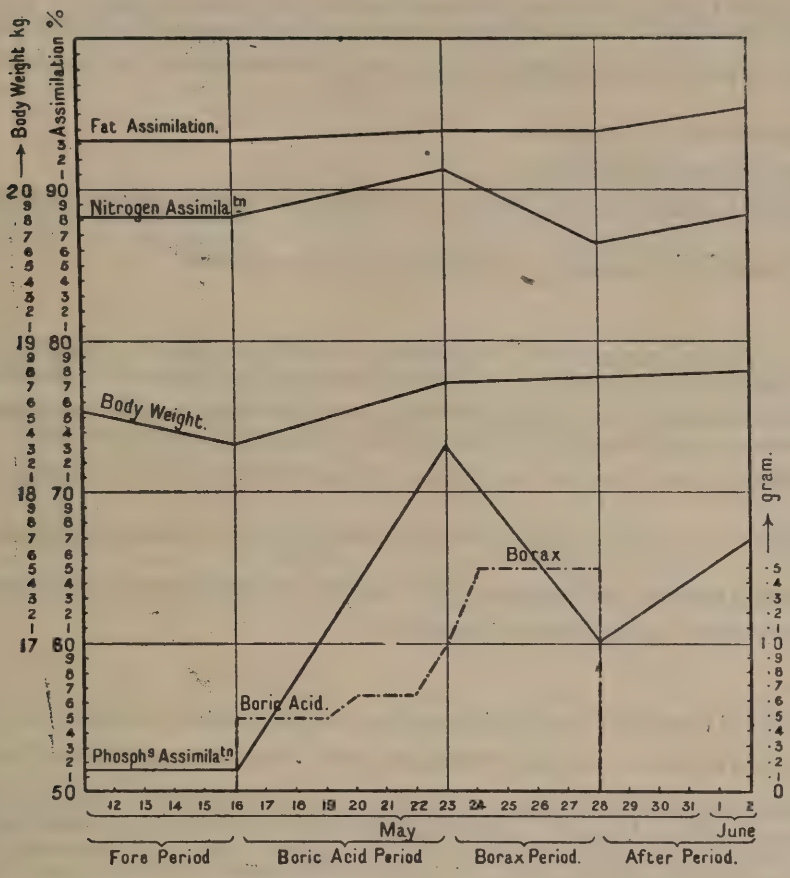
Showing the influence of boric acid and borax upon the body weight, and upon the nitrogen, phosphorus, and fat assimilation of three children.

Child A.

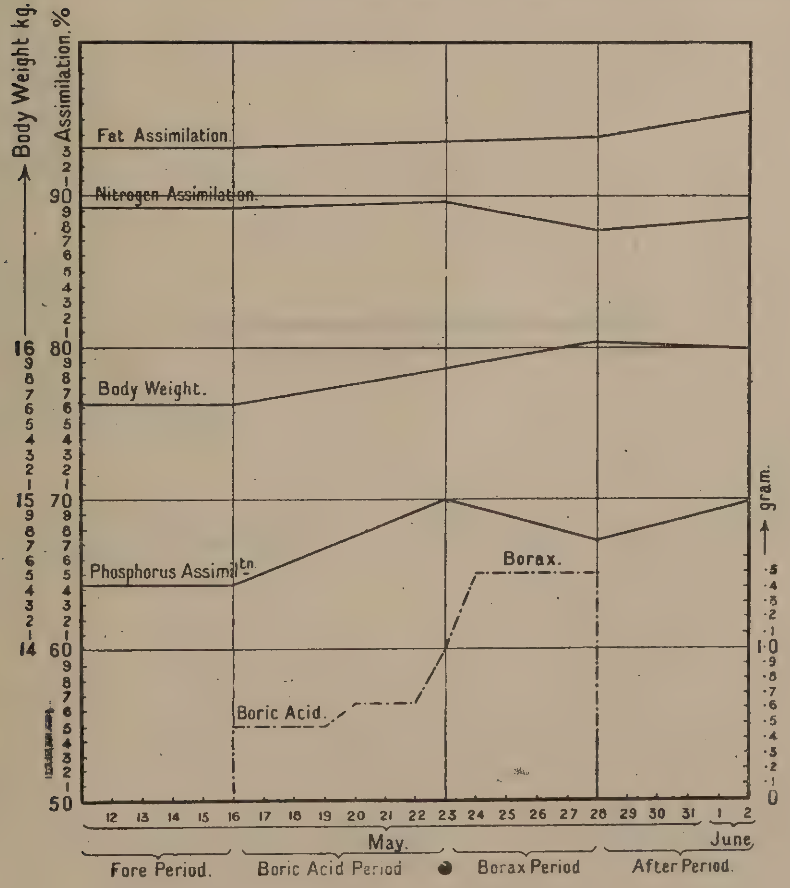


Appendix.

Child B.



Child C.



General Conclusions.

Boric Acid.

(1.) Small doses up to 1 gramme per diem, continued for some time, exert, in healthy or delicate children, no influence upon proteid metabolism. The assimilation of the proteid food was improved in one healthy child (*B.*)

(2.) The phosphorus metabolism was unaffected in all cases. The assimilation of phosphorus was in all cases improved.

(3.) The assimilation of fat was not affected.

(4.) The body weight increased in all cases.

(5.) The quantity of dry fæces was not affected. Their nitrogen and phosphorus percentage was slightly decreased.

(6.) No inhibitory effect upon intestinal putrefaction could be demonstrated.

Borax.

(1.) Continued doses of 1·5 grammes have no influence in healthy or delicate children upon proteid metabolism. The proteid assimilation was unaffected in healthy children, slightly depressed in the delicate child.

(2.) The phosphorus metabolism was not affected in healthy or delicate children. The assimilation of phosphorus was improved in all cases, the improvement being least marked in the case of the delicate child.

(3.) The fat assimilation was improved in the case of one healthy child, and unaffected in the case of the others.

(4.) The body-weight was increased in all cases, the increase was most marked in the case of the delicate child.

(5.) The weight of dry fæces and their nitrogen and phosphorus percentage remained unaltered.

(6.) Borax tended rather to increase intestinal putrefaction.

Boric Acid and Borax.

(1.) Both boric acid and borax were quickly eliminated, no cumulative action being therefore probable.

(2.) Neither boric acid nor borax in any way affected the general health and well-being of the children.

If we compare these results with those obtained in the only previous complete observation made by Forster (loc. cit.) on the action of boric acid upon the general metabolism of one adult man, we find that they are only in accord in so far as in neither could any material effect upon the general health and metabolism be observed. In none of our three cases, however, could we confirm Forster's single observation that boric acid caused an increase in the quantity of fæces and in their nitrogen and phosphorus percentage. Further, in contradistinction to Forster, we were unable to find that boric acid exerted any inhibitory effect on intestinal putrefactive action.

If, on the other hand, we compare our results upon children with those obtained by Chittenden and Gies (loc. cit.) with similar doses of these substances upon the metabolism of dogs, it will be seen that in the essential points they agree.

Appendix.

APPENDIX No. VIII.

TABLES, COMPILED UNDER THE DIRECTION OF PROFESSOR THORPE, GIVING THE RESULTS OF ANALYSES OF SAMPLES OF FOOD AND DRINK MADE IN THE GOVERNMENT LABORATORY, IN RELATION TO CONTAINED PRESERVATIVES AND COLOURING MATTERS.

Table A.

Showing the Number of Samples of Imported Produce Examined in the Government Laboratory, and the Preservatives found therein.

No.	Description.	Total Number of Samples.	Preservatives.			Total containing Preservatives.	Percentage Preserved.
			Boric Acid.	Salicylic Acid.	Sulphites.		
1	Ham - - - - - -	62	58	—	—	58	93·5
2	Bacon - - - - -	68	62	—	—	62	91·2
3	Cheese - - - - -	62	—	—	—	—	—
4	Condensed Milk - - -	20	—	—	—	—	—
5	Preserved Meat - - - -	73	5	—	—	5	6·8
6	Wine - - - - - -	9	—	—	1	1	11·1
7	Beer - - - - - -	107	—	19	20	39	36·4
8	Fruit Pulps - - - -	10	—	—	—	—	—
9	Potted Meats - - - -	4	—	—	—	—	—
10	Meat Extracts - - - -	12	—	—	—	—	—
11	Preserved Fish - - - -	44	—	—	—	—	—
12	Preserved Vegetables - -	45	—	—	—	—	—
13	Preserved Fruits - - -	48	—	—	2	2	4·2
14	Sausages - - - - -	16	8	—	—	8	50·0
15	Vinegar - - - - -	2	—	—	—	—	—
16	Sauces and Ketchups - -	10	—	1	1	2	20·0
17	Sugar - - - - - -	15	—	—	—	—	—
18	Spices - - - - -	22	—	—	—	—	—
19	Miscellaneous (as Cocoa, Soups, Cornflour, Honey, Gelatine, &c.) - - - - -	19	—	—	—	—	—
	Totals - - -	648	133	20	24	177	27·3

Appendix.

TABLE B.

Place.	Importer.	Foods.
London	Corderoy, Hibernia Chambers, London Bridge.	Danish bacon.
	Harvey, Lockie & Co., 16, Mincing Lane.	Jam pulps.
	Peck & Co., Snow Hill	Tinned and potted meats.
	Wylie & Co., Love Lane, Eastcheap	Tinned fruits, peas and tomatoes.
	Travers & Sons, 119, Cannon Street	Honey, caper powder, capers, tinned fruit, dried fruits, essences, olive oil, vinegar, preserved fish, and corn flour.
	Chate & Harris, 1, West Smithfield	Potted goods.
	McCall & Co., 6, Eastcheap	Tinned mutton, beef, tongue and rabbit.
	Richens, Mr., 30, Tooley Street	Canadian cheeses.
	Thompson & Co., 35, Tooley Street	Danish bacon.
	Trengrouse, 51, Tooley Street	Danish bacon.
	The Morris Beef Co., 6, Eastcheap	Potted goods.
	Pantein, 147, Upper Thames Street	Potted meats.
	Fischel, Rood Lane	Jam pulp, tinned and bottled fruits.
Liverpool	W. P. Sinclair & Co., 12, North John Street.	Bacon, ham, cheese.
	J. Morrell & Co., 57, Victoria Street	Ham, bacon.
	Messrs. Nickson, 15, Victoria Street	Ham, bacon, cheese, tinned fruits.
	Pelling, Stanley & Co., Mathew Street.	Tinned fruits, brawn, tongue, rabbit and fish, preserved fish, meat extracts and sausages.
	H. A. Lane & Co., Mathew Street	Corned beef.
	Simpson, Roberts & Co., Stanley Street.	Tinned lobster, pineapple, apricots, pears, peaches, salmon, tomatoes and peas, honey, dried apples, Norwegian and French sardines.
Manchester	Willer & Riley, Corporation Street	Bacon, milk (skimmed and full), cheese.
	John Chadwick & Sons, Corporation Street.	Tinned peaches, pineapples, pears, apricots, salmon, lobsters, preserved fish, sardines.
	Manchester & Salford Equitable Co-operative Society, Downing Street, Ardwick.	Bacon, cheese, tinned milk, meats, fruits and fish, preserved peas and fish, meat extracts, dried fruit, sauces, essences, potted meats.
Glasgow	Andrew Clement & Sons, South Albion Street.	Tinned beef, mutton, rabbit and salmon.
	J. Laird & Co., Ingram Street	Ham, bacon and beef.
	Cooper & Co., Howard Street	Tinned milk, peas, meats and fruits, bottled fruits, vegetables, peas, potted meats, French vinegar, foreign oils, dried fruits, fish, tinned fish and sauces,
	Scottish Co-Operative Wholesale Society, 95, Morriston Street.	Bacon, ham, milk, cheese, preserved peas, tinned meats, fruits and fish, meat extracts, dried fruits, preserved fish and sauces.
Edinburgh	Donald, Stewart & Co., 40, Constitution Street, Leith.	Bacon, ham, cheese, tinned fruits, tongue, and salmon, sardines, beef, mutton, rabbit, "roast beef."
Leith	Scottish Co-Operative Wholesale Society, Links Place.	Sugars, sardines, cheese.

Appendix.

TABLE C.

COMPARISON of Samples of MILK and Cream purchased in London and the Provinces on Sundays with those purchased on WEEK-DAYS (examined in the GOVERNMENT LABORATORY).

MILK.

—	—	—	Percentage preserved.
Sundays	* 128	32 Boric Acid, 6 Formalin	28·9
Week-days	35	4 „ 1 „	14·2
TOTAL	163	Of which 25·7 per cent. contain preservatives.	

* One of the above milks contains both boric acid and formalin.

CREAM.

—	—	—	Percentage preserved.
Sundays	*76	40 Boric Acid, 1 Salicylic, 2 Formalin	53·9
Week-days	†52	48 „ 1 „ 2 „	94·2
TOTAL	128	Of which 70·3 per cent. contain preservatives.	

* Two of above creams contain both Boric and Salicylic Acids.
† Two contain both Boric Acid and Formalin.

TABLE D.

SHOWING NUMBER of SAMPLES of CREAM containing BORIC PRESERVATIVE, purchased from DAIRIES and SHOPS respectively in the undermentioned districts of the METROPOLIS, during the Month of February 1900, and examined in the GOVERNMENT LABORATORY.

DISTRICTS.	Dairies.		Shops.	
	Number of Samples.	Number containing Preservatives.	Number of Samples.	Number containing Preservatives.
Mile End	1	—	3	3
Shoreditch	4	2	2	2
Camberwell	3	1	2	2
St. Mary Abbotts	4	4	3	3
St. Mary, Islington	3	3	4	4
Lambeth	5	4	3	3
Wandsworth	7	6	3	3
Bethnal Green	—	—	1	1
St. George-in-the-East	2	—	1	1
Hampstead	4	4	5	5
Plumstead	2	2	3	3
St. Marylebone	5	5	4	4
Hammersmith	—	—	3	3
Fulham	5	5	1	1
City of London	1	1	2	2
St. Pancras	3	3	5	5
St. Martin-in-the-Fields	4	4	—	—
St. James, Westminster	1	1	—	—
St. George, Hanover Square	2	1	3	3
TOTAL	56	46=82%	48	48=100 %

TABLE E.

HOSPITAL SAMPLES.

Examined in the GOVERNMENT LABORATORY.

(A.) Number containing Preservatives and Artificial Colouring.

Hospital and kind of Samples.	Total received.	Boron Preservatives.	Colour.	
			Vegetable.	Coal-tar.
Charing Cross:				
Milk	6	—	—	—
Butter	6	6	1	—
Great Northern:				
Milk	5	—	—	—
Butter	10	10	—	6
Great Ormond Street (Children):				
Milk	11	—	—	—
Butter	10	10	8	—
King's College:				
Milk	6	—	—	—
Butter	6	6	5	1
London:				
Milk	5	—	—	—
Butter	5	5	1	—
Bacon	1	1	—	—
Condensed Milk	1	—	—	—
Ginger Beer	1	—	—	—
Port Wine	1	—	—	—
Pendlebury, near Manchester (Children):				
Milk	6	—	—	—
Butter	6	—	3	—
Middlesex:				
Milk	6	—	—	—
Butter	12	12	6	—
St. Bartholomew's:				
Milk	6	—	—	—
Butter	6	6	1	—
St. George's:				
Milk	4	4	—	—
Butter	4	3	1	2
Cream	4	4	—	—
St. Mary's:				
Milk	7	—	—	—
Butter	14	13	6	4
Cream	7	7	—	—
St. Thomas's:				
Milk	4	—	—	—
Butter	8	6	—	—
Victoria (Children):				
Milk	2	—	—	—
Butter	2	2	—	—
Westminster:				
Milk	6	—	—	—
Butter	6	4	1	5
Total	184	99	33	18
Percentage	—	53·8	18	10

The preservative (exclusive of salt) was in all cases a boron compound.

The vegetable yellow used for colouring was invariably annatto, and the coal-tar colour employed gave in nearly every instance the reaction of "butter-yellow" (dimethylamido-azo-benzene).

Appendix.

Table F.

Hospital.	Sample.	Percentage of Boric Acid.		
		Minimum.	Maximum.	Average.
Charing Cross	Butter	·10	·45	·291
Great Northern	ditto	·14	·89	·466
Great Ormond Street (Children's)	ditto	·19	·69	·462
King's College	ditto	·38	·52	·431
London	ditto	·54	·91	·702
Middlesex	ditto	·32	·55	·410
St. Bartholomew's	ditto	·15	·85	·503
St. George's	ditto	·20	·65	·425
St. Mary's	ditto	·11	·53	·330
St. Thomas'	ditto	·18	-79	·533
Victoria	ditto	·43	·45	·440
Westminster	ditto	·10	·36	·187
AVERAGE	-	·24	·64	·432
St. George's	Milk	·03	·20	·086
	Cream	·22	·29	·266
St. Mary's (Cream)		·17	·41	·272

N.B.—The above percentages may be converted into *grains per pound* in the case of Butter by multiplying by 70, and by 87·5 to convert percentages of Boric Acid in Milk and Cream into *grains per pint.*

The highest amounts were found in Samples from London Hospital.

Table G.

	Temperance Wines and Cordials.							Herb-Beers and Temperance Drinks.								
	Total Samples.	Salicylic Acid.	Boric Acid.	Sulphites.	Salicylic and Sulphites.	Total Preserved.	Percentage Preserved.	Total Samples.	Salicylic Acid.	Boric Acid.	Sulphites.	Formalin.	Salicylic and Sulphites.	Salicylic and Boric.	Total Preserved.	Percentage Preserved.
(1) Excise samples (small Traders)	–	–	–	–	–	–	–	338	9	20	4	3	–	7	43	12·7
(2) Special samples (important Traders):																
(*a*) London	34	12	–	3	17	32	94·1	58	22	–	3	–	–	–	25	43·
(*b*) Provinces	69	41	–	3	10	54	78·2	200	33	2	12	–	–	–	47	23·5
TOTALS	103	53	–	6	27	86	83·5	596	64	22	19	3	–	7	115	19·3

TABLE II.

PRESERVATIVES supplied by MANUFACTURERS and other TRADERS.

(A.) BORIC PRESERVATIVES.

The figures in ordinary type express *Percentages*, and those in *Italics Grains Per Pint* of Liquid Foods and *Per Pound* of Solid Foods.

N.B.—It will be observed that in this Table the Percentage of the active ingredient often slightly exceeds 100. This is due to the fact that the whole of the boron preservative has been calculated in the usual manner as Boracic Acid—$B(HO_3)$—whether present as Boracic Acid, Borax, or other form of Borates. The effect of expressing Anhydrous Borax, for example, as Boracic Acid, is to increase the percentage in the ratio 50·5 to 62·0. The amount of Anhydrous Borax actually present varied between the limits 3·8 per cent. and 24·9 per cent., the average amount being 10 per cent.

Progressive Number.	Price per Lb.	Amount of the active Preservative Ingredient recommended by the Trader (as per directions for use) expressed in Percentages, and in Grains Per Pint for Liquid, and in Grains Per Pound for Solid Foods.										Percentage of the Active Preservative Ingredients found on Analysis.							Observations.
		Strength of Solution.	Milk.	Cream.	Butter and Margarine.	Sausages, Polonies, Pork Pies, Lard.	Butcher's Meat, Fish, Game, Poultry, Ham, Bacon.	Eggs.	Brine.	Fruit and Jam.	Soups, Gravies, and Jellies.	Total Boric Preservative, as Boracic Acid.	Common Salt.	Cane Sugar.	Salicylic Acid.	Formaldehyde.	Saltpetre.	Bicarbonate of Soda.	
	s. d.																		
1	3 –	5 per cent.	0·078	0·31	0·445	0·42	Powder or solution.	—	0·625	—	0·089	101	—	—	—	—	—	—	—
			6·9	*27·3*	*31·1*	*29·4*	—	—	—	—	*7·8*								
2	5 –	2·3 per cent.	0·058	0·116	0·23	Solution	Solution	Solution	—	0·36	0·58	46·8	—	—	—	—	—	—	Contains 53·2 per cent. of glycerine.
			5·1	*10·2*	*16·1*	—	—	—	—	*25·2*	*5·1*								
3	–	3·5 per cent.	0·054	0·072	Immerse in solution.	0·432	Powder or solution.	—	—	—	0·072	69·1	—	28·7	—	—	—	—	Sugar is sometimes added to preservatives intended for cream (*see also* No. 32).
			4·7	*6·2*	—	*30·2*	—	—	—	—	*6·3*								
4	–	5 per cent.	—	—	—	0·641	Powder or solution.	—	—	—	0·103	102·5	—	—	—	—	—	—	—
						44·8	—	—	—	—	*7·4*								
5	–	5 per cent.	0·078	0·156	0·9	0·446	Powder or solution.	—	—	0·9 to the sugar.	0·62	101·6	—	—	—	—	—	—	—
			6·8	*13·6*	*63·0*	*31·2*	—	—	—	*63·0*	*54·5*								
6	–	—	0·16	0·16	0·96	—	Powder mixed with equal parts of salt and saltpetre.	—	2½ per cent. added to pickle containing salt and saltpetre.	—	—	102·4	—	—	—	—	—	—	—
			14·0	*14·0*	*67·2*														
7	–	5 per cent.	0·16	0·16	0·96	—	Powder or brine with 2½ per cent. of preservative.	—	do.	—	—	102·9	—	—	—	—	—	—	—
			14·0	*14·0*	*67·2*														
8	1 –	10 per cent.	—	—	0·72	0·625	—	5 per cent. solution.	1·25	—	—	100·1	—	—	—	—	—	—	—
					50·4	*43·7*													
9	1 4	—	0·078	—	—	—	—	—	—	—	—	101·0	—	—	0·8	—	—	—	*Note.*—A small amount of salicylic acid is used in addition to the boric preservative.
			6·8																
10	2 0	—	—	0·155	—	—	—	—	—	—	—	99·5	—	—	2·2	—	—	—	—
				13·6															
11	–	5·8 per cent.	0·080	0·106	0·820	0·645	Solution or Powder.	Solution	—	—	0·108	103·2	—	—	—	—	—	—	—
			7·1	*9·3*	*57·4*	*45·1*	—	—	—	—	*9·3*								
12	1 –	4·35 per cent.	0·072	0·109	0·78	0·26	Powder or solution.	8·7 solution.	8·7 to the brine.	0·78	0·068	87·0	—	—	—	—	—	—	—
			6·3	*9·5*	*54·6*	*18·2*	—	—	—	*54·6*	*6·0*								

13	1 9	5 per cent.	0·078 *6·8*	0·187 *16·4*	—	0·446 *31·2*	Powder or solution.	10 p. cent. solution.	1·667 added to brine.	—	—	99·0	—	—	—	—	—	—	—
14	1 6	5·15 per cent.	0·08 *7·0*	0·19 *16·6*	—	—	—	—	—	—	—	103·3	—	—	—	—	—	—	—
15	1 6	5·2 per cent.	0·08 *7·0*	0·19 *16·6*	—	—	—	—	—	—	—	104·4	—	—	—	—	—	—	Coloured with an Eosin dye.
16	–	5 per cent.	0·078 *6 8*	0·25 *21·9*	Fresh 1·04 *72·8* Salt 0·893 *62·5*	0·624 *43·7*	Powder or solution.	—	—	—	—	101·8	—	—	—	—	—	—	—
17	–	5 per cent.	0·085 *7·4*	0·127 to 0.191. *11·1 to 16·7*	0·912 *63·8*	0·41 *28·7*	Powder or solution.	—	1·66	—	—	102·2	—	—	—	—	—	—	—
18	–	4·6 to 6·90	0·71 to 1·0 *6·2 to 9·3*	Small quantity.	1·637 *114·5*	—	—	—	—	—	—	91.7	—	—	—	—	—	—	—
19	–	*5 per cent.	0·038 *3·4*	0·077 *6·8*	0·71 *49·7*	—	Solution.	2·5	—	—	—	49·6	15·3	—	—	—	—	29·1	* These percentages refer only to the *boric* preservative. † Double these quantities are recommended for butter to be kept 7 or 8 months.
20	–	—	—	—	—	0·52 *36·4*	—	—	—	—	—	101·7	—	—	—	—	—	—	—
21	–	4·65 per cent.	0·073 *6·3*	0·116 *10·2*	0·83 *58·1*	0·84 *58·8*	Powder or solution.	9·3	—	—	—	93·0	—	—	—	—	—	—	*See also* No. 35, a formalin preservative for milk, and No. 47, a sodium-silicate solution for eggs.
22	1 –	5 per cent.	0·0785 to ·157 *6·9 to 13·7*	0·3125 to ·625 *27·3 to 54·6*	0·31 *21·7*	—	Five per cent. solution.		—	—	—	99·0	—	—	—	—	—	—	—
23	– 7	5·2	0·11 *9·5*	0·13 to 0·194 *11·3 to 17*	0·93 *65·1*	0·463 *32·6*	Powder or solution.	10·4	—	—	—	103·8	—	—	—	—	—	—	—
24	–	5·2	—	—	—	0·467 *32·7*	Powder or solution.	—	1·74	—	—	104·5	—	—	—	—	—	—	—
25	– 7	5·16	0·103 *9·0*	0·125 to 0·187 *10·9 to 16·3*	0·921 *64·5*	0·460 *32·2*	Powder or solution.	10·3	—	—	—	103·2	—	—	—	—	—	—	—
26	1 6	4 per cent.	0·125 *10·9*	0·25 *21·8*	½ oz. per gallon of brine.	0.39 *27·3*	Powder or solution.	—	—	0·9 to the sugar.	—	98·6	—	—	—	—	—	—	—

TABLE H.—*continued.*

PRESERVATIVES supplied by MANUFACTURERS and other TRADERS—*continued.*

(A) BORIC PRESERVATIVES—*continued.*

The figures in ordinary type express *Percentages*, and those in *Italics Grains Per Pint* of Liquid Foods and *Per Pound* of Solid Foods.

Pro-gressive Number.	Price per Lb.	Amount of the active Preservative Ingredient recommended by the Trader (as per directions for use) expressed in Percentages, and in Grains per Pint for Liquid, and in Grains per Pound for Solid Foods.										Percentages of the Active Preservative Ingredients found on Analysis.							Observations.
		Strength of Solution.	Milk.	Cream.	Butter and Margarine.	Sausages, Polonies, Pork Pies, Lard.	Butcher's Meat, Fish, Game, Poultry, Ham, Bacon.	Eggs.	Brine.	Fruit and Jam.	Soups, Gravies, and Jellies.	Total Boric Preservatives, as Boracic Acid.	Common Salt.	Cane Sugar.	Salicylic Acid.	Formaldehyde.	Saltpetre.	Bicarbonate of Soda.	
27	1	7·22	0·0565	0·128	0·62	0·41	Powder or Solution.	4·1 Solution.	—	—	—	82·5	8·1	—	—	—	7·8	—	Only the percentages of *boracic acid* recommended for use are given.
						0·82													
			5·0	*11·2*	*43·4*	*28·7*													
						57·4													
28	—	—	0·126	—	—	—	—	—	—	—	—	105·9	—	—	—	—	—	—	This firm also supplies a Preservative for Separated Milk (see No. 38) which contains Formalin.
			11·0																
29	—	—	—	0·49	—	—	—	—	—	—	—	103·8	—	—	—	—	—	—	—
				42·9															
30	1 -	5	0·079	0·079	0·456	0·456	Solution.	—	—	—	—	102·3	—	—	—	—	—	—	—
			6·9	*6·9*	*32·0*	*32·0*													
31	—	9·2	0·072	—	Fresh. 0·92	0·46	For Bacon add 10 per cent. to 20 per cent. to Brine.	—	9·2 to 18·4	—	—	92·0	10·0	—	—	—	—	—	—
			6·3		*64·4*	*32·2*													
32	—	—	—	0·071	Salt. 0·46		—	—	—	—	—	79·2	—	23·1	—	—	—	—	—
				6·2	*32·2*														
33	1 3	5·2	0·087	—	0·928	Sausages. 0·371													
			7·6		*65·0*	*26·0*	Powder or Solution.	10·4 Solution.	—	—	—	104·0	—	—	—	—	—	—	—
						Lard. 0·463													
						32·4													
34	—	—	0·014	—	·007 to ·014	Added to the Cream.	—	—	—	—	—	35·0	—	—	—	—	3·2	56·1	Note the large amount of *alkali* used to neutralise the acidity of the milk. See also No. 36, the basis of which is *Formalin*.
			1·2		*0·5–1·0*														
					Mean = ·0105 = 0·7														

TABLE H.—*continued.*

PRESERVATIVES supplied by Manufacturers and other Traders—*continued.*

(B.) THE following contained FORMALDEHYDE.

Progressive Number.	Name of Preservative.	Percentage of Formaldehyde in Solution.		Amount recommended by the Trader for Use in different Foods.		
		A. As Sold.	B. As ready for Use.	Kind of Food.	Directions for Use.	Proportion of Formaldehyde in the Food.
35	Formalin solution	5 per cent. (approximate.)	0·3 per cent.	Milk - -	Half pint of B in 16 gallons of milk.	1 : 82,000
				Meat - - Fish - - Poultry - Game - - Eggs - -	Either dip in Solution B, or sponge over the articles.	—
36	Lactic fluid - -	10 per cent. (approximate.)	—	Milk - -	One tablespoonful in 10 gallons of milk.	1 : 32,000
				Butter -	One tablespoonful in 4 gallons of water.	The butter is allowed to steep for half hour in the antiseptic solution, then the liquid is worked out.
37	Liquid preservative	1·1 per cent.	—	Milk and cream.	One gill to 16 gallons.	1 : 50,000 (approximate.)
38	Preservative for separated milk.	0·12 per cent.	—	Separated milk.	One pint to 18 gallons.	1 : 120,000
39	Steryl - - -	20 per cent.	0·75 per cent.	Milk - -	Quarter pint of B to 16 gallons of milk.	One grain of CH$_2$O per gallon. 1 : 70,000

(C.) THE following consisted of various kinds of SALT.

Progressive Number.	Name of Preservative.	Percentage of Salt as NaCl.	Observations by Trader.
40	Dairy salt - - - -	99·5	———
41	Dairy salt - - - -	98·3	For butter and cheese, 3 per cent. suffices to keep butter for more than six months.
42	Curer's or packer's salt -	98·9	The best kind for pork packing or bacon curing; also used on the Pacific Coast for salmon and lobster tinning.
43	Fishery salt (No. 1) - -	92·4	For Scotch and Yarmouth herring and Irish mackerel Fisheries (150 lbs. in 400 lb. barrel of fish).
44	Fishery salt (No. 2) - -	95·3	A better quality than No. 43, as it is free from iron impurity.
45	Coarse common salt - -	97·7	Used for general purposes by curers and packers in the United Kingdom as more adapted for use in our damp climate than No. 42.

(D.) "MISCELLANEOUS" PRESERVATIVES.

Progressive Number.	Name of Preservative.	Use, &c.
46	Egg preservative - -	The eggs are kept in the solution, which contains, approximately, 1 per cent. of sodium silicate.
47	Beta-naphthol. Sulphonate of soda.	Supplied by the "Sal Prœservare" Company, and said to be used on the continent.

Appendix.

TABLE J.

SOME QUANTITATIVE DETERMINATIONS of the Amount of Preservatives in Foods Examined in the GOVERNMENT LABORATORY.

(A.)—Boric Preservative.

For the following estimations of the amount of boric acid those samples were selected (with the exception of the hospital samples, all of which were examined) which indicated on preliminary qualitative examination, a relatively large amount of the preservative.

(*a.*) Milks. (14 samples examined.)

Maximum	·104 per cent. as B (HO)$_3$	= 9·1 grains per pint.
Minimum	·015 „	= 1·3 „
Average	·062 „	= 5·4 „

(*b.*) Creams. (9 examples examined.)

Maximum	·651 per cent. as B (HO)$_3$	= 57 grains per pint.
Minimum	·114 „	= 10 „
Average	·366 „	= 32 „

(*c.*) Sausages, Potted Meats and Brawn. (11 samples examined.)

Maximum	·943 per cent. as B (HO)$_3$	= 66 grains per lb.
Minimum	·217 „	= 15 „
Average	·477 „	= 33 „

(*d.*) Butters. (10 samples examined.)

Maximum	·935 per cent. as B (HO)$_3$	= 65·5 grains per lb.
Minimum	·264 „	= 18·5 „
Average	·477 „	= 33·3 „

(*e.*) Margarines. (8 samples examined.)

Maximum	1·05 per cent. as B (HO)$_3$	= 73·5 grains per lb.
Minimum	0·10 „	= 7 „
Average	0·43 „	= 30 „

(*f.*) Bacon. (10 samples examined.)

Maximum	·661 per cent. as B (HO)$_3$	= 46·3 grains per lb.
Minimum	·123 „	= 8·6 „
Average	·329 „	= 23·0 „

(*g.*) Temperance Beverages.

(1.) Temperance wines and cordials. (Nil.)

(2.) Herb beers and similar temperance drinks. (8 samples.)

Maximum	·083 per cent. as B (HO)$_3$	= 7·3 grains per pint.
Minimum	·013 „	= 1·2 „
Average	·043 „	= 3·8 „

(*h.*) Hospital samples.

(1.) Butter. (83 samples.)

Maximum	·91 per cent. as B (HO)$_3$	= 63·7 grains per lb.
Minimum	·10 „	= 7·0 „
Average	·432 „	= 30·2 „

(2.) Cream. (7 samples from St. George's and St. Mary's only.)

Maximum	·41 per cent. as B (HO)$_3$	= 36 grains per pint.
Minimum	·17 „	= 15 „
Average	·268 „	= 23·5 „

(3.) Milk. (3 samples from St. George's only.)

Maximum	·20 per cent. as B (HO)$_3$	= 17·5 grains per pint.
Minimum	·03 „	= 2·6 „
Average	·086 „	= 7·5 „

(B.)—Salicylic Preservative. (As Salicylic Acid.)

(*a*.) Jams. (13 samples taken indiscriminately.)

Maximum	·121 per cent.	= 8·5 grains per lb.
Minimum	·024 ,,	= 1·7 ,,
Average	·055 ,,	= 3·8 ,,

(*b*.) Temperance Drinks.

(1.) Temperance wines and cordials. (10 samples examined.)

Maximum	·22 per cent.	= 19 grains per pint.
Minimum	·017 ,,	= 1·5 ,,
Average	·103 ,,	= 9 ,,

(2.) Herb beers and similar beverages. (25 samples.)

Maximum	·093 per cent.	= 8·1 grains per pint.
Minimum	·006 ,,	= 0·5 ,,
Average	·030 ,,	= 2·6 ,,

(*c*.) Imported Beers. (19 samples.)

Maximum	·039 per cent.	= 3·4 grains per pint.
Minimum	·015 ,,	= 1·3 ,,
Average	·025 ,,	= 2·1 ,,

(C.)—Sulphites. (Estimated as sulphur di-oxide.)

(*a*.) Temperance Drinks. (Lime juice, ginger wine, lemon syrup, raspberry cordial and peppermint.) (13 samples examined.)

Maximum	·052 per cent. as $(SO)_2$	= 4·5 grains per pint.
Minimum	·001 ,,	= 0·1 ,,
Average	·021 ,,	– 1·8 ,,

(*b*.) Imported Beers. (20 samples examined by Customs.)

Maximum	0·018 per cent. as $(SO)_2$	= 1·6 grains per pint.
Minimum	0·002 ,,	= 0·2 ,,
Average	0·008 ,,	= 0·7 ,,

(D.)—Formalin.

Cream	1 Cream. Less than 1 in 00,000. 3 ,, Trace. 4 Samples.
Milks	1 Milk. 1 in 100,000. Maximum for milk. 2 ,, 1 in 150,000. 2 ,, Less than 1 in 1,000,000. 2 ,, Trace. 7 Samples.
Temperance Drinks	1 Temperance drink, 1 in 25,000, maximum for temperance drinks. 2 ,, 1 in 100,000. 3 Samples.
Fish	2 Fish had been dipped in formalin solution, but the amount of the preservative was not estimated.

Appendix.

TABLE K.

PERCENTAGE of FOODS found by various observers to contain PRESERVATIVES.

Kind of Food.	Percentage containing Preservative.	Authority.	District.
Milk	18·2	Government Laboratory	Home and abroad.
Do.	13·0	Dr. Walford	Cardiff.
Do.	9·0	Dr. Hill	Birmingham.
Do. (*a*)	1·4	Mr. W. C. Williams	Lancaster.
Do. (*a*)	0·7	Do.	Liverpool.
Butter	57·1	Government Laboratory	Home and abroad.
Do.	50·0	Mr. L. K. Boseley	London.
Do.	44·5	Dr. Walford	Cardiff.
Do.	28·0	Dr. Hill	Birmingham.
Do.	26·5	Dr. Williams	Glamorgan.
Margarine	"nearly all"	Mr. W. C. Williams	Liverpool.
Do.	84·0	Dr. Hill	Birmingham.
Do.	77·4	Government Laboratory	Home and abroad.
Meat foods (*b*)	64·0	Dr. Hill	Birmingham.
Miscellaneous (*b*)	33·0	Do.	Do.

(*a*) With the exception of these milks (which were preserved with formalin) all the above foods contained Boron Preservatives.

(*b*) The percentages of these foods found in the Government Laboratory to be preservatised are given in detail in Table .

TABLE L.

MAXIMUM Amounts of PRESERVATIVES found in various FOODS by different observers.

Nature of Preservatives.	Kind of Food.	Amount of Preservatives.		Authority.
		Percentage.	Grains per pint of Liquid and per lb. of Solid Foods.	
Boracic Acid	Milk (*a*)	0·914	80·0 (*a*)	Prof. A. W. Blyth.
Do.	Do.	0·300	26·2	Dr. W. Williams.
Do.	Do.	0·230	20·0	Mr. W. F. Lowe.
Do.	Do.	0·200	17·5	Government Laboratory.
Do.	Do.	0·180	15·7	Dr. A. Hill.
Do.	Do.	0·144	12·6	Mr. C. E. Cassal.
Do.	Do.	0·140	12·2	Mr. W. W. Fisher.
Do.	Do.	0·105	9·2	Dr. E. Walford.
Do.	Do.	0·029	2·5	Dr. J. L. Cameron.
Do.	Condensed Milk (*b*)	0·500	43·7 (*b*)	Dr. Voelcker.
Do.	Cream (*c*)	0·800	70·0 (*c*)	Mr. O. Hehner.

(*a*) This amount is given in the evidence as "Borax."

(*b*) This sample of condensed milk is from Australia.

(*c*) The percentage of preservatives in cream is sometimes given in grains per lb., but is here expressed in all cases as grains per pint.

MAXIMUM amounts of Preservatives found in various Foods by different observers—*continued.*

Nature of Preservative.	Kind of Food.	Amount of Preservatives.		Authority.
		Percentage.	Grains per Pint of Liquid and per Lb. of Solid Foods.	
Boracic acid	Cream	0·651	57·0	Government Laboratory.
Do.	Cream (clotted)	0·515	45·0	Mr. C. E. Cassal.
Do.	Cream (ordinary)	0·450	39·4	Mr. Jas. Hudson.
Do.	Cream	0·434	38·0	Mr. W. C. Williams.
Do.	do.	0·325	28·5	Mr. C. E. Cassal.
Do.	do.	0·200	17·5	Mr. C. W. Sorensen.
Do.	Butter	1·600	112·0	Dr. W. Williams.
Do.	do.	1·300	91·0	Dr. J. H. Jones.
Do.	do.	1·020	71·4	Dr. E. Walford.
Do.	do.	1·000	70·0	Mr. W. W. Fisher.
Do.	do.	0·935	65·5	Government Laboratory.
Do.	do.	0·885	62·0	Mr. W. C. Williams.
Do.	do.	0·714	50·0	Mr. W. F. Lowe.
Do.	do.	0·705	49·3	Mr. H. D. Richmond.
Do.	Margarine	1·050	73·5	Government Laboratory.
Do.	Sausages	1·140	79·8	Dr. J. Tubb Thomas.
Do.	do.	0·943	66·0	Government Laboratory.
Do.	do.	0·500	35·0	Mr. H. D. Richmond.
Do.	Ham and bacon	0·661	46·3	Government Laboratory.
Do.	do.	0·340	23·8	Mr. W. C. Williams.
Do.	do.	0·300	21·0	Dr. J. Tubb Thomas.
Do.	do.	0·130	9·1	Mr. H. D. Richmond.
Do.	Temperance drinks	0·083	7·3	Government Laboratory.
Salicylic acid	British wines	0·210	18·4	Dr. E. Hope.
Do.	do.	0·220	19·2	Government Laboratory.
Do.	do.	0·200	17·5	Mr. W. C. Williams.
Do.	do.	0·038	3·3	Mr. C. E. Cassal.
Do.	Lime Juice cordial	0·154	13·5	Mr. W. C. Williams.
Do.	do.	0·100	8·7	Mr. C. E. Cassal.
Do.	Cider	0·654	0·5	Mr. H. Symons.
Do.	Beer (bottled)	0·010	0·9	Mr. C. E. Cassal.
Do.	„ (imported)	0·039	3·4	Government Laboratory.
Do.	Sherry	0·0023	0·2	Mr. C. E. Cassal.
Do.	Port	0·0045	0·4	do.
Do.	Jam	0·121	8·5	Government Laboratory.
Do.	do.	0·064	4·5	Mr. W. C. Williams.
Do.	do.	0·050	3·5	Dr. Voelcker.
Sulphites (as SO_2)	Temperance drinks	0·052	4·5	Government Laboratory.
Do.	Beer (imported)	0·018	1·6	do. do.
Formalin	Milk	1 in 100,000		do. do.
Do.	Cream	less than 1 in 100,000		do. do.
Do.	Temperance drinks	1 in 25,000		do. do.

Appendix.

TABLE M.

CONVICTIONS under the FOOD and DRUGS ACTS for the Addition of CHEMICAL PRESERVATIVES to FOOD.*

District.	Analyst, &c.	Food.	Preservative.	Percentage of Preservative Found.	Grains per Pint or per Pound.
Birmingham - -	Dr. Hill - - -	Milk - -	Boric acid - -	0·08—0·18	7—15·7
Buckingham - -	Mr. W. W. Fisher -	do - -	- do. - - -	0·14	12·2
Glamorgan - - -	Dr. Williams - -	do. - -	- do. - - -	0·13—0·3	11·3—26·2
Liverpool - - -	Mr. W. C. Williams -	do. - -	Formalin - -	—	—
London - - -	Mr. Cassal - - -	Cream - -	Boric acid - -	0·464	40·6 (pint).
Birmingham - -	Dr. Hill - - -	Butter - -	- do. - - -	0·9—1·6	63—112
Glamorgan - - -	Dr. Williams - -	do. - -	- do. - - -	0·6—1·6	42—112
Pontypool - - -	Dr. J. H. Jones - -	do. - -	- do. - - -	1·3	91
Westminster - -	Mr. Bannister - -	Lager beer -	Salicylic acid - -	—	—

* Compiled from the evidence of witnesses before the Committee.

TABLE. N.

SUMMARY of SAMPLES of FOOD (both HOME and IMPORTED PRODUCE) and the COLOURING MATTERS found therein. (Examined in the GOVERNMENT LABORATORY.)

No.	Description.	Total Samples.	Colouring Matters.				Total Containing Colouring Matters.	Percentage Coloured.
			Coal-tar.	Vegetable.	Animal.	Mineral.		
1	Milk - - - - - -	296	—	3	—	—	3	1·0
2	Cream - - - - -	290	9	1	—	—	10	3·4
3	Butter - . - - -	364	40	87	—	—	127	34·9
4	Margarine - - - -	133	100	15	—	—	109 (*a*)	81·9
5	Cheese - - - - -	196	5	107	—	—	111 (*b*)	56·6
6	Condensed Milk - - -	86	—	—	—	—	—	—
7	Bacon - - - - - -	210	—	—	—	—	—	—
8	Ham - - - - - -	185	—	—	—	—	—	—
9	Sausages - - - -	226	72	1	1	—	74	32·7
10	Potted Meats - - -	165	27	2	—	3	32	19·4
11	Preserved Meats - -	135	—	—	1	—	1	0·7
12	Prawn - - - - -	56	6	—	—	—	6	10·7
13	Fresh Fish - - - - -	43	—	—	—	—	—	—
14	Preserved Fish . - -	44	—	—	—	1	1	2·3
15	Meat Jellies - - -	25	3	—	1	—	4	16·0
16	Fruit Jellies - - -	28	9	—	4	—	13	46·4
17	Pork Pies - - - -	48	—	—	—	—	—	—
18	Lard - - - - - -	52	—	—	—	—	—	—
19	Jam - - - - - -	150	10	—	—	—	10	6·7
20	Preserved Fruits - -	48	4	—	—	2	6	12·5
21	Fruit Pulp - - - - -	10	—	—	—	—	—	—
22	Preserved Vegetables - -	49	—	—	—	17	17	34·7
23	Lime and Lemon Juice -	78	1	—	—	—	1	1·3
24	Cordials - - - -	24	12	—	2	—	14	58·3
25	Fruit Syrups - - -	23	12	—	1	—	13	56·5
26	Temperance Drinks - -	769	56	—	1	—	57	7·4
27	Imported Beers - - -	100	—	—	—	—	—	—
28	Wines and Beers - -	32	—	—	—	—	—	—
29	Vinegar - - - - -	77	—	—	—	—	—	—
30	Meat Extracts - - -	50	—	—	—	—	—	—
31	Sauces and Ketchups - -	10	5	3	—	—	8	80·0
32	Soups - - - - - -	49	1	—	—	—	1	2·0
33	Sugars - - - - -	149	24	—	—	—	24	16·1
34	Spices - - - - - -	22	—	2	—	2	4	18·2
35	Miscellaneous - - - - (Invalid Foods, &c.)	29	2	—	—	—	2	6·9
	TOTALS - - -	4,251	398	221	11	25	648	15·2

(*a*) Six of these contained both vegetable and coal-tar yellows.
(*b*) One - ditto - ditto - ditto.

Appendix.

TABLE O.

SAMPLES of COLOURING MATTERS used in the TRADE, and Examined in GOVERNMENT LABORATORY.

No.	Name.	Use.	Quantity recommended.	Nature.
1	Annatto extract	Milk	——	Annatto in water.
2	Cowslip colour	do.	One teaspoonful to 16 gallons of milk.	do.
3	Butter colour	Butter	——	Annatto in oil.
4	do.	do.	——	do.
5	do.	do.	One teaspoonful in 200 litres of milk (44 gallons).	do.
6	do.	do.	One teaspoonful to four gallons of cream.	Annatto in water.
7	do.	do.	One teaspoonful in five gallons of milk.	Coal-tar yellow in oil. ("Butter yellow") (Di-methyl-amido-azo-benzene).
8	do.	do.	——	Coal-tar yellow in alkaline solution.
9	do.	do.	One teaspoonful to three gallons of cream.	Annatto in oil.
10	do.	do.	——	do.
11	do.	do.	——	do.
12	Oil butter colour	do.	——	Coal-tar yellow. "Butter yellow" (*see* above).
13	Oleo butter colour	do.	One teaspoonful to five gallons of milk before churning.	Annatto in oil.
14	do. do.	do.	——	do.
15	Annatto colour	Cheese	One oz. to 70 lbs. of cheese	Annatto in water.
16	Extract of annatto	do.	One tablespoonful to 30 lbs. of cheese.	do.
17	Cream colour	Cream	——	Mixture of Annatto and a coal-tar yellow (Tropœolin) in water.
18	Armenian bole	Sausages, &c.	——	Ferruginous earth.
19	Camwood	do.	——	Camwood chips.
20	Crystal roseine	do.	——	Coal-tar red (fuchsin).
21	Indian red	do.	——	Coal-tar red (sulphonated azo-red).
22	Rose pink	do.	——	do. do.
23	Food colour	do.	Half oz. to 60 lbs. of meat	do. do.
24	do.	do.	do. do.	do. do. and starch.
25	Ham, chicken, and tongue dye.	Ham, chicken, and tongue.	——	Coal-tar red (corresponds with Congo red).
26	Polony colour	Skins of Polonies.	——	Coal-tar red (sulphonated azo-red)
27	Polony dye	do. do.	——	do. do.
28	Brown dye	Imitation of smoked hams.	——	Coal-tar red and brown (Mixture of an azo-red red and brown allied to Bismark brown).
29	Logwood	Various	——	Logwood chips.

Appendix.

TABLE P.

LIST of COLOURING MATTERS used in CONFECTIONERY, from Mr. L. K. BOSELEY (KEILLER & SON, SILVERTOWN).

Number.	Trade Names.	Colours.	Scientific Names.
1	French Cream Pink (Rhodomine).	Reds	Hydrochlorate of the phthalein of di-ethyl-meta-amido-phenol.
2	Concentrated Pink		A mixture of hydrochlorate of rosaniline with milk, sugar, or starch.
3	Magenta		Fuchsin, hydrochlorate or acetate of rosaniline.
4	Rhodites		Hydrochlorate of phthalein of di-ethyl-meta-amido-phenol.
5	Cherry Red		Sodium salt of tetra-iod-fluorescin.
6	Ponceau Red		Biebrich or Crocein scarlet. Sodium-benzene-napthol-sulphonic acid.
7	Vermilion		A pure aniline colour.
8	Rose Red		Purified aniline colour. Guaranteed harmless.
9	Saffron Yellow	Yellows, &c	*Probably* the sodium salt of amido-azo-benzene sulphonic acid.
10	Primrose Yellow		Auramine. (This colour is sold in three grades, 1, 2, and 0).
11	Imperial Yellow		Ammonium or sodium salt of hexanitrodiphenylamine.
12	Citron Orange		The sodium salt of xylene-sulphonic-acid-axo-B.-naphthol.
13	Chocolate Brown	Brown and Black	An aniline colour. (No details as to composition).
14	Jetoline Black		Probably di-amine black.
15	Heliotrope	Violets	Hoffman's violet R., hydrochlorate of tri-ethyl rosaniline.
16	Lavender		A mixture of Hoffman's violet.
17	Damson Blue		Also a mixture of Hoffman's violet.

The following colours are also used. (Scientific names not given). Rose paste, brown paste, Tuscan, orange, and salmon pink. The first two are probably mixtures of some of the above named colours, with aluminium hydroxide.

Appendix.

TABLE Q.

CONFECTIONERY COLOURED ARTIFICIALLY. SENT by MR. L. K. BOSELEY (KEILLER & SON, SILVERTOWN).

Fondants - - - - -	Cream pink (rose) - - - - - - - -	——
	Imperial yellow (pale cold yellow).	
	Heliotrope (very pale lavender).	
	Mixture of 1 and 2.	
Mixed bouquet cachous - -	Lemon yellow and real saffron (yellow) - - - -	1 in 23,000 to 1 in 5,000 (·004 to ·02 per cent.)
	Rhodime and raspberry red (decided rose red).	
	,, heliotrope (purple).	
	Jetoline black and heliotrope (slate colour).	
	Citron Orange (pale orange).	
	Heliotrope (lilac colour).	
Oriental beans - - - -	Rose pink (crimson) - - - - - - - -	1 in 3,500 to 1 in 1,000 (·028 to 0·1 per cent.)
	Lemon yellow (greenish yellow).	
	Citron orange (only just perceptible).	
	Chocolate brown (reddish brown).	
	Jetoline black (slaty black).	
Sugar boilings - - - -	Rose pink (pale and dark rose) - - - - - - -	1 in 5,500 to 1 in 2,500 (·018 to ·04 per cent.)
	,, and Jetoline black (reddish brown).	
	Vegetable yellow (pale yellow).	
	Citron orange (pale and dark orange).	
	Chocolate brown and jetoline black (dark brown).	
Fruit jujubes - - - - -	Red with cochineal - - - - - - - -	——
	Yellow with apricot (real) (orange yellow).	
	Green (with liquid blue colour).	
Gum jujubes - - - - -	Rose pink (decided red) - - - - - - -	1 in 5,500 (·018 per cent.)
	Citron orange (orange).	
	Lemon yellow (very slight yellow).	
	Damson blue (bluish violet).	
Cachous - - - - -	(a) Rhodamine (pink) - - - - - - -	1 in 23,000 (·004 per cent.)
	(b) Heliotrope (reddish violet) - - - - - -	1 in 7,500 (·013 per cent.)
	(c) Lavender (bluish violet) - - - - - -	1 in 5,000 (·02 per cent.)
Lozenges - - - - - -	Rhodamine (pale pink to deep rose) - - - - -	1 in 30,000 to 1 in 2,340 (·003 to ·0428 per cent.
	Lemon yellow (pale cold yellow).	
Gelatin jujubes - - - -	Rose pink - - - - - - - - - -	1 in 5,500 (·018 per cent.)
	;, and black currant (purplish red).	
	,, and orange (reddish orange).	
	,, and damson blue (dark violet).	
	Citron orange (decided orange).	
Cupid lozenges - - - -	Concentrated pink - - - - - - - - -	1 in 33,000 to 1 in 17,000 (·003 to ·00588 per cent.)
	Cream pink.	
	Lemon yellow.	
	Lavender.	
	Citron orange.	
Buttons - - - - - -	Concentrated pink - - - - - - - -	Same proportions as last group.
	Cream pink.	
	Lemon yellow.	
	Chocolate brown.	
	Lavender.	

TABLE R.

MAXIMUM AMOUNTS of COLOURING MATTERS found in FOODS by various observers.

Kind of Food, &c.	Colouring Matter.	Amount of Colouring Matter.	Authority.
Preserved Vegetables (Peas, &c.).	Copper sulphate (*a*)	·094 per cent. = 6·6 grs. per lb.	"Sanitary Record" (1897).
- - do. - - do.	- - do.	·022 ,, 1·5 ,,	Mr. Vasey.
- - do. - - do.	- - do.	·016 ,, 1·1 ,,	Professor A. W. Blyth.
- - do. - - do.	- - do.	·010 ,, 0·7 ,,	Mr. W. F. Lowe.
- - do. - - do.	- - do.	·010 ,, 0·7 ,,	M. Riche (Paris).
- - do. - - do.	- - do.	·0085 ,, 0·6 ,,	Mr. Cassal.
Piccalilli	Turmeric	4 lbs. to 40 gallon barrel	Mr. L. K. Boseley.
Pickled Cabbage	Sulphuric acid (*b*)	- - do. - - do.	- - ditto.
Milk	Annatto	1 in 300,000.	- - ditto.
Sweets	Oxide of Iron	0·4 per cent. = 28 grs. per lb.	Mr. Cassal.
Bloater Paste	- - do.	0·34 ,, 24 ,,	Mr. Fisher.

(*a*) In the evidence, the copper colouring matter is variously described as "copper," "copper sulphate" or "crystallised copper sulphate," but the figures in the above table are in all cases expressed in terms of *metallic* copper.

The above figures multiplied by four will give approximately the amount expressed as crystallised sulphate of copper.

(*b*) Sulphuric acid, though not itself a colouring matter, has the property (common to acids generally) of acting on pickled cabbage so as to produce a bright red colour.

APPENDIX No. IX.

RAILWAY TRANSPORT OF MILK AND BUTTER IN ENGLAND.

With a view to secure information from the chief railway companies having termini in London, and whose lines traverse the milk and butter producing counties of England, the following letter was sent to nine companies, namely:—The Great Central, Great Eastern, Great Northern, Great Western, London, Brighton, and South Coast, London and North-Western, London and South-Western, Midland, and South-Eastern and Chatham Railway Companies:—

Local Government Board, Whitehall, S.W.,
5th October, 1900.

Dear Sir,

The Food Preservatives Committee, appointed by the President of this Board, have found occasion during the progress of their investigations to make inquiry concerning methods of transport by land and water as regards parts of the Continent and Ireland, and they are desirous of having information from the great railway companies of England concerning the facilities granted for the carriage, especially, of milk and butter.

The Committee will therefore be very glad if you will kindly furnish them with information on the following points as regards your railway system, and upon any other matters which seem to you to be pertinent to the inquiry in question.

(1) Are any special trucks set apart for the conveyance of milk or butter?

(2) Are these commodities sent alone or in conjunction with other articles, and, if so, what?

(3) Is milk or butter sent in refrigerating cars or in ice-wagons?

(4) If not, have the wagons used for such produce double walls and roofs and any special methods of ventilation?

(5) Do milk and butter go by passenger or goods trains?

(6) Are any special precautions taken to keep trucks so used in the shade during the heat of summer while awaiting their cargoes at provincial stations?

(7) What are the maximum distances in one and another direction from which milk and butter are carried, and how many hours are occupied in the journey to London?

(8) Is the milk and butter traffic on your railway extensive, and have any complaints been received as to damage of produce in transport?

Trusting that you will be good enough to furnish information on the above several points for the purposes of the Committee.

I am, yours faithfully,
(Signed) Chas. J. Huddart,
Secretary to the Committee.

The Traffic Superintendent,
———— Railway Company.

The following replies have been received:—

Great Central Railway.

I beg to give you the information so far as this company is concerned:—

(1) We have a large traffic in butter and margarine, for which special vehicles are provided.

(2) About 90 per cent. of the traffic is conveyed alone. The other 10 per cent. is carried with general merchandise.

(3) We have neither refrigerator cars nor ice-wagons.

(4) The special vehicles are built in the ordinary way, but with ventilated sides (louvred), but protected on the inside with perforated zinc. They are also fitted with four Torpedo ventilators in the roof.

(5) Butter is chiefly conveyed by special butter trains.

(6) No special precautions are taken to keep trucks so used in the shade in summer.

(7) The greater proportion of our butter traffic passes between Grimsby Docks and Manchester, distance 100 miles, the usual time occupied by the special trains conveying same being about four hours. We have no butter traffic to London.

(8) The butter and margarine traffic is extensive, some 10,000 packages being received at Grimsby weekly. Considering the weight of the traffic and the nature of same the complaints are very small, and not more than the average for general merchandise.

William Pollitt,
General Manager.

7th November, 1900.

Great Eastern Railway.

The quantity of butter produced in our district is comparatively small, and is usually sent packed with other commodities of farm produce for home consumption under the arrangement referred to in the enclosed pamphlet.*

(1) Yes, on certain trains for milk.

(2) Milk sent alone; butter usually in small consignments, as previously stated.

(3) No.

(4) For the conveyance of milk: the vans are specially constructed for the purpose, and ventilated with louvres at the sides.

(5) Principally by passenger train.

(6) As far as circumstances will permit.

(7) About 130 miles; the time occupied on the journey being approximately four hours.

(8) During 1899 we conveyed, without complaints of damage in transport, about 580,000 cans containing about 7,000,000 Imperial gallons of milk.

H. G. Drury,
Superintendent of the Line.

11th October, 1900.

Great Northern Railway.

I give you below the particulars asked for:—

(1) Special vehicles are set apart for the conveyance of milk by passenger or special train from the milk-producing districts of Nottinghamshire, Derbyshire, and Staffordshire, but not for butter, which is conveyed in the guard's van by passenger train and in goods wagons by goods train.

(2) Milk from the above-mentioned districts is usually sent in special trains, but when only small quantities are forwarded it is carried with the ordinary parcels traffic in the guard's van. Milk is not conveyed by goods trains.

(3) and (4) Refrigerating vans are not provided for milk and butter on the Great Northern Railway, nor have vehicles provided for such produce double walls and roofs. They are, however, well ventilated. When practicable, refrigerator vans are used for the conveyance of butter by goods train.

(5) Milk is conveyed by passenger or by special train, and butter by both passenger and goods trains.

(6) No special steps are taken for this purpose.

(7) The maximum distance milk is conveyed on the Great Northern Railway is about 150 miles, the time occupied being about five hours 25 minutes.

Butter is received in London in large quantities from Liverpool (200 miles), Newcastle (271 miles), and Grimsby (155 miles), and delivery is made the day after despatch. From these ports butter is sent all over the G.N. line.

(8) An extensive milk traffic comes from the Nottinghamshire, Derbyshire, and Staffordshire districts. The butter traffic from these districts is not extensive.

Complaints as to damage are very occasional.

J. Alexander.

30th November, 1900.

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* Not reproduced here.

GREAT WESTERN RAILWAY.

Concerning the facilities afforded for the conveyance of milk and butter over the Great Western Railway, I have pleasure in giving an answer in detail to each of the various questions contained in your communication:—

(1) Are any special trucks set apart for conveyance of milk or butter?—Milk is principally conveyed by passenger train, or by trains appointed for the exclusive purpose of conveying milk under passenger train conditions. The empty cans are worked in the same manner on the return journey. Milk is carried in passenger train vehicles, so constructed as to permit of an efficient draught of air through them, and at the same time afford shelter from the sun. The roofs of the vehicles are painted white. Moreover, with a view to the milk being carried by rail under the most favourable sanitary conditions, the vehicles used for its conveyance are retained as far as is practicable exclusively for the service. Butter when sent in large quantities is, where possible, carried in special vans, lined with zinc and with ventilators at each end. A very large proportion of this traffic, however, is forwarded by the traders in small lots, and is conveyed either in the vans used for merchandise traffic generally; or in some particular cases in vans with open sides and whitened roofs.

(2) Are these commodities sent alone or in conjunction with other articles, and if so, what?—By far the larger proportion of the milk traffic is conveyed separately from anything else. The exception is with odd cans and small lots, which generally travel in the guard's van. Butter, when forwarded in small quantities in boxes, tubs, baskets, crocks, cools, or hampers, is frequently loaded in wagons containing general merchandise.

(3) Is milk or butter sent in refrigerator cars or in ice wagons?—In England, milk is not generally conveyed in refrigerator cars, the distance being so short. On the Great Western Railway, the distance for which milk is carried would probably average about 60 miles. The vehicles are constructed as explained in answer to Question No. 1. Butter, in full loads, is carried in refrigerator cars so far as circumstances permit, or in the specially-constructed vans referred to in answer to Question No. 1. The refrigerator cars are fitted with ventilators and receptacles for ice. The major portion of the salted butter traffic is carried in the regulation merchandise vans.

(4) If not, have the wagons used for such produce double walls and roofs, and any special methods of ventilation?—The regulation merchandise van used by the company is stoutly built, but the walls and roofs are not double. The vans are sufficiently ventilated.

(5) Do milk and butter go by passenger or goods train?—Milk is carried almost entirely by passenger train, principally late at night, and early in the morning. Fresh butter is conveyed by passenger train or by goods train, as may be ordered by the trader; and salted butter nearly always travels by goods train.

(6) Are any special precautions taken to keep trucks so used in the shade during the heat of summer while awaiting their cargoes at provincial stations?—The point as regards the vehicles for the conveyance of milk is dealt with in answer to Questions No. 1. With regard to butter, the general custom is for it to be handled and dealt with under cover; and the vans intended for the conveyance of the traffic are placed in position in the roofed goods station or sheds as long as is practicable before the train time.

(7) What are the maximum distances in one and another direction from which milk and butter are conveyed, and how many hours are occupied in the journey to London?—Ninety-nine per cent. of the milk traffic received in London by Great Western Railway is from stations within 150 miles distant, and the time occupied in its conveyance for the full distance might be about six hours. It is explained, in answer to Question No. 3, that our average distance for conveying milk is about 60 miles, and the average time occupied would be about two hours. An important centre for milk forwarding to London is the Wiltshire Dairy district surrounding Swindon, a distance of 77 miles. This district is served by fast trains, appointed exclusively for the milk business, and the journey from Swindon to London by one of these trains occupies only 95 minutes. Milk is forwarded in small quantities for distances beyond 150 miles and up to about 300 miles, and the time occupied in the case of the longest journey would be about 11 hours. It has been found from experience that farmers and other senders of milk attach as much importance to the working of the returned empty cans, as they do to the conveyance of milk. This means in practice that every milk sending station must have its own service of milk vans or trucks independently of other stations, which necessitates the carriage of the returned empty churns being conducted by special trains or by passenger trains. At Paddington Station we have provided a line with approach road and extra platform exclusively for the accommodation of milk, and to keep it apart from the ordinary traffic. To illustrate the care taken in dealing with this branch of the company's business, one of the service orders regulating its working at the London stations is attached.* The longest distance butter is conveyed by passenger train is from the South and West of Ireland to London, about 600 miles in all, and the time taken for its conveyance is about 24 hours. In addition, goods trains are used for salted butter from these districts, and the service to London occupies from 30 to 36 hours. Butter is also carried from the under-mentioned places by goods trains, and the approximate times occupied in transit are as shown below:—

Station.	Miles.	Approximate Train Journey.
Penzance - -	327	16 hours.
Helston - - -	325	18 ,,
Redruth - - -	309	14 ,,
Penryn - - -	309	16 ,,

(8) Is the milk and butter traffic on your railway extensive, and have any complaints been received as to damage of produce in transport?—The Great Western Company are the largest carriers of milk in the United Kingdom, the quantity conveyed by them during the year 1899 being as set out below:—

No. of Cans.	No. of Gallons.
1,642,380	23,495,925.

The company are fully alive to the great importance of dealing with this business in a thoroughly smart and efficient manner, as will be illustrated by some of the earlier answers, and they spare no expense to give satisfaction and encouragement to the traders in milk. The result is that complaints of alleged damage to milk in transit have practically disappeared.

Some short time since it was represented to me by influential persons that the senders of milk were inconvenienced by certain of the branch lines of the company being closed on Sunday, which necessitated the supplies on that day being carted to the nearest main line station. With the desire of sympathetically dealing with every matter affecting the agriculturists of the districts served by the Great Western line, the question received careful consideration; and, as a result, Sunday trains by which milk is conveyed are in recent months being run upon the following branch lines in dairy districts.

Calne.
Malmesbury.
Highworth.
Fairford.

It may be added that it has just been decided, with the same object, to extend the Sunday service on the Wells branch.

It may be mentioned that in the course of the proceedings on the Sale of Food and Drugs Bill in the early part of 1899, it was represented that hardship had arisen in connection with the prosecution of milk producers in cases where it had arisen that pure milk handed to a carrier for conveyance was suspected upon arrival at destination to have been adulterated.

It was further alleged that the railway companies required milk churns to be unlocked (except in cases where an additional charge for conveyance was made) a requirement which did not allow of precautions being taken to prevent persons from tampering with the milk whilst in charge of the company.

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* Not reproduced here.

Appendix.

These representations were placed before the railway companies for their observations, and in reply it was explained that a wrong impression existed so far as the railway arrangements were concerned, because as a matter of fact, the companies provide for and actually carry milk in sealed churns, the only condition being that the churns should have the tare weight stamped on the outside so that the declared contents might be checked by allowing 10¼lbs. for every gallon of milk.

Sealing is equivalent to locking, and it makes no difference to the railway companies whether the churns are sealed or locked; but, as the churns are never locked, it may be the dealers consider that, in practice, there would be a difficulty in arranging for the locking and unlocking of churns, which difficulty does not exist in the case of sealing.

About 400 sealed churns are received at Paddington daily, and I should be very glad to see the number largely increased, because there is good reason for believing that a certain amount of "blending" takes place. This practice may be beneficial for those consumers who would otherwise be supplied with the poor descriptions of milk; but it is not so satisfactory to those who desire to be supplied with the best milk that is procurable.

The butter traffic is extensive, being carried in considerable quantities from the South and West of England, and the South and West of Ireland to London; to the Midlands, and to the North of England. Imported butter is largely distributed from London, Bristol, and the other ports.

During very hot weather, complaints are sometimes received in regard to butter traffic, but every effort is made to avoid damage in transit, and the number of grievances is not large.

If, instead of farmers making up the butter on their own premises, they would combine, in each district, to establish a factory to which the milk could be sent for the purpose, this would not only enable the butter to be manufactured under better sanitary conditions, but would also allow of its being packed in such a manner, and sent in such quantities as would enable a through van to be run with it to destination, thereby ensuring its delivery in good condition. Could such a combination among the producers be brought about, the traffic could, no doubt, be handed to the railway companies at regular times and in reasonable quantities, in which event the Great Western Company would be quite prepared to make special arrangements for its conveyance on similar lines to those which exist in the case of milk traffic.

J. F. Wilkinson.

22nd November, 1900.

London, Brighton, and South Coast Railway.

(Home Traffic.)

Your letter of the 14th inst. I regret I have been unable to send you an earlier reply, but trust that the following particulars will be of interest.

For the purpose of reference I have answered the questions in the order they occur in your communication:—

(1) Milk is carried on the platform of carriage trucks or in the luggage vans of passenger trains, according to the extent of accommodation required. Butter is usually carried in box vans or covered trucks. There is no demand for special trucks.

(2) Milk and butter are very rarely sent in conjunction.

(3) No.

(4) No.

(5) Milk only by passenger trains; butter by both services.

(6) Yes, when occasion requires, and the shade is available.

(7) The maximum distance between extreme points on the railway is only 86 miles, though the aggregate mileage is 487 miles. The time occupied on journeys may be a maximum of about 3½ hours by passenger train or about 10 hours by goods train.

(8) Milk traffic is fairly considerable; butter traffic of home produce very small. Few grounds of complaint arise as to damage in transport.

D. Greenwood.

19th April, 1901.

Continental Traffic.

Your favour of the 5th inst. addressed to the Traffic Superintendent, has been referred to me, as I understand your inquiry, so far as this company is concerned, is confined to foodstuffs from the Continent.

In the first place I would remark that we do not carry fresh milk from the Continent. We have been asked to do so on several occasions, but have declined in the interests of British producers.

We bring large quantities of Italian butter in boxes and baskets, which travel in through trucks from Italy to Dieppe, whence they are shipped to Newhaven, and then forwarded by rail to London, or to Brighton, Eastbourne, etc. This traffic is confined to the winter months.

We have also a service of steamers between Caen and Newhaven, and a considerable amount of Normandy butter travels by that route. This comes, in larger or smaller quantities, all the year round.

Although we have a few refrigerating vans, butters as a rule travel in ordinary trucks, box vans for preference.

We generally have sufficient butters to make up complete truck loads or if not we load with eggs.

The bulk of our butter being forwarded at "Petite Vitesse" rates, it is conveyed from Newhaven to London by goods trains, which generally travel by night.

I shall be pleased to furnish any further particulars which your Committee may desire.

J. W. Wylie,
Continental Traffic Manager.

10th October, 1900.

London and North Western Railway.

I beg to reply *seriatim* as follows to the eight questions embodied in your communication:—

(1) Special trucks are set apart for milk, but not for butter.

(2) Milk is largely sent alone, but in some cases with other articles. Butter generally with other articles.

(3) No.

(4) The wagons used have not double walls or roof, but they are specially ventilated.

(5) Milk goes by passenger trains, and butter to a large extent by goods trains.

(6) There are no special means of doing this.

(7) The longest distance milk is carried is from Tarff (Glasgow and South Western Railway) to Euston, which is handed to this company at Carlisle. The distance is 359 miles. As regards butter, that sent from Knocklong (G. S. and W. Railway) to Euston, viâ North Wall, represents the extreme point, the distance being 456 miles. The time occupied in the journey to London for the milk is about 8¾ hours, and for the butter 15½ hours.

(8) Very considerable traffic in milk and butter by passenger trains is conveyed on the London and North Western Company's line, and the complaints as to damage, etc., to milk and butter by passenger trains are very few.

F. Harrison.

24th October, 1900.

London and South Western Railway.

With reference to your application concerning the methods of transport of milk and butter traffic, I beg to give below a few particulars as to this company's practice, and will deal with your questions in numerical order, viz.:—

(1) Special vans are provided for the conveyance of milk traffic, which are specially constructed so as to give plenty of ventilation, but butter traffic is generally conveyed in the guard's van, unless there is a sufficient quantity to warrant a special van being used, in which case it would be loaded into an ordinary closed van or a guard's van, whichever vehicle was available.

(2) Milk traffic is generally conveyed by special train, but in some cases churns are also conveyed by ordinary passenger trains; butter is conveyed by ordinary trains.

(3) We do not provide refrigerator vans or ice wagons for the conveyance of milk and butter traffic.

(4) Milk vans are not fitted with double walls, but they are well ventilated at the sides.

(5) Milk traffic is not conveyed by goods train, but butter is sent by goods as well as passenger train.

(6) There is no accommodation at the majority of country stations, where vans can be placed under cover in the shade, and milk and butter traffic is usually loaded up either at a siding when a special truck is used, or at the platform after arrival of the trains, by which it is to be conveyed, and on arrival at Waterloo the milk churns are immediately unloaded and sent down a lift into the milk arch below, which is, of course, very cool, and butter traffic would be taken to the Parcels Office, and sent down the lift to the arch below to await delivery.

(7) The bulk of the milk traffic is drawn from the following stations, viz.:—Yeovil Junction, Sherborne, Milborne Port, Templecombe (including Somerset and Dorset Stations), Gillingham, Semley, Tisbury, Dinton, Wilton, Salisbury, and Porton, and the time occupied between Yeovil Junction and London by the milk train would be between 4 and 5 hours.

(8) The number of churns of milk which were dealt with at Vauxhall and Waterloo alone during the 12 months ending October 31st last was 511,170, and the traffic at Clapham Junction and other large stations is very great. We also have a very extensive traffic in farm and dairy produce, which is conveyed at special cheap rates. With regard to the question of complaints of damage I think that the number of complaints we receive is extremely small in proportion to the amount of traffic which is dealt with.

SAM FAY.

11th January, 1901.

MIDLAND RAILWAY.

I have the pleasure to enclose herewith a statement answering *seriatim* the inquiries of the Food Preservatives Committee in regard to the conveyance of milk and butter by railway.

G. H. TURNER.

27th November, 1900.

(1) Are any special trucks set apart for the conveyance of milk or butter?—Special vehicles are used for the conveyance by passenger train of full loads of milk in churns. Butter is not conveyed in specially constructed wagons but generally with other articles by goods train.

(2) Are these commodities sent alone or in conjunction with other articles, and, if so, why?—If not a full truck load butter forwarded by the goods train service is loaded along with other goods. Butter in small quantities and occasional churns of milk are conveyed in luggage or parcels vans by passenger trains.

(3) Is milk or butter sent in refrigerating cars or in ice-wagons?—It is not our practice to use refrigerator vans for milk and butter.

(4) If not, have the wagons used for such produce double walls and roofs, and any special methods of ventilation?—The sides of vehicles provided specially for the conveyance of milk are boarded outside and inside, but the roof is not double. The ends and sides are louvred for ventilation.

(5) Do milk and butter go by passenger or goods trains?—Butter and condensed milk are principally forwarded by goods train. Fresh milk is chiefly sent by passenger train service.

(6) Are any special precautions taken to keep trucks so used in the shade during the heat of summer while awaiting their cargoes at provincial stations?—No. Generally speaking the heavy milk traffic passes during the night.

(7) What are the maximum distances in one and another direction from which milk and butter are carried, and how many hours are occupied in the journey to London?—The maximum distances milk is conveyed by passenger train by our route from the North and West to London are:—Distance, Glasgow to London, 423 miles; time occupied, 12 hours. Berkeley Road to London, 197 miles; time occupied, 8 hours. We have no precise particulars of the transit of condensed milk and butter conveyed by goods trains.

(8) Is the milk and butter traffic on your railway extensive, and have any complaints been received as to damage of produce in transport?—The quantity of milk and butter carried by the Midland route is extensive. Complaints as to damage in transit are comparatively few, and it is generally found that, in the case of butter, the damage arises through the defective packages used by the senders.

Midland Railway,
General Manager's Office,
Derby, November, 1900.

SOUTH-EASTERN AND CHATHAM AND DOVER RAILWAYS.

I have the pleasure to send you herewith for the information of the Food Preservatives Committee replies to the inquiries propounded by them, both as regards our passenger and goods departments.

A. WILLIS,
General Manager.

19th October, 1900.

Conveyance of Milk and Butter by Railway.

PASSENGER.

(1) No milk and butter are conveyed in the ordinary luggage vans.

(2) These commodities are sent in conjunction with luggage and ordinary parcels.

(3) No.

(4) No.

(5) Butter by both, but milk by passenger almost exclusively.

(6) No.

(7) With regard to milk about 50 miles.

(8) Milk traffic comparatively not extensive.

GOODS.

(1) Butter is sent in ordinary trucks.

(2) With ordinary merchandise, unless there is enough to fill a truck, and in that case the butter is sent by itself.

(3) As to butter, no.

(4) No.

(5) Principally by goods.

(6) Yes, so far as is practicable, but consignees are eager to receive early.

(7) Butter by goods trains is sent a maximum distance of 86 miles from London.

(8) Traffic from London heavy.

APPENDIX No. X.

AN HISTORICAL RECORD OF THE USE OF PRESERVATIVES AND COLOURING MATTERS IN FOOD, GLEANED FROM THE VOLUMES OF THE "LANCET," from 1851 to the present time. By Mr. *S. A. Vasey*, F.I.C., F.C.S., Consulting Chemist to the "Lancet."

[Attention was drawn incidentally to the preservation and artificial colouring of food with the commencement of the labours of the Analytical Sanitary Commission of the "Lancet," which was instituted in the year 1851 by the late Mr. Thomas Wakley, M.P., the founder of the journal. The gross forms of fraud which this Commission brought to view are in the main not related to the specific subject which the present Committee on Preservatives are considering. Nevertheless, some important points are touched upon which bear distinctly upon the history of the employment of preservatives and colouring matters in food, which I venture to think will be of interest to the Committee.

The first report, dealing with the adulterations of Coffee, contains little that is germane to the subject, but in the "Lancet" of 20th September, 1851, the Adulterations of Milk are described. In this article mention is made of the use of turmeric added for the purpose of producing in milk a richness of colour, making the dilution with water and abstraction of cream less apparent. In the same article reference is made to the addition of carbonate of soda to prevent milk from turning sour. Milk thus treated may be kept, it is said, for eight or ten days. Again, milk of almonds is referred to as being sometimes present in milk, and as oil of almonds is decidedly antiseptic the object of its addition was probably for preserving purposes or as a corrective. This seems to be the first historic reference to the use of preservatives in milk.

The next reference to the use of a preservative is in connection with the addition of sulphuric acid to Vinegar. The "Lancet" Commission (the "Lancet," p. 52, Vol. I., 1852) regarded this addition as unnecessary since some makers dispensed with it altogether. As a result of the enquiry it was shown that of 33 samples analysed eight samples contained a quantity of sulphuric acid not exceeding the amount permitted to be added, while in the remaining cases the amount exceeded this, and in some instances was three or four times as great.

The next enquiry (1852) related to Pickles and their adulteration, and here again the presence of free sulphuric acid was shown and of copper in varying amounts in the samples purchased. In two instances the amounts were poisonous. The pickles which contained the largest quantity of copper were those which consisted entirely of green vegetables, as girkins and beans. "One of the worst features of this abominable practice," remark the "Lancet" Commission, "is that the employment of copper is wholly unnecessary as the colour of green vegetables may be very well preserved by other means as by the use of pure vinegar and the addition of a proper quantity of salt."

The next important article dealt with Preserved Provisions, and appeared in the "Lancet" of 20th March, 1852. In this article reference is made to the means of preserving various foods, but the only preservatives mentioned are salt, sugar, oil, charcoal, acetic acid, pyroligneous acid, and alcohol. A number of samples was examined, including carrots, turnips, peas, rhubarb, cabbage, Brussels sprouts, potatoes, apples, extract of beef, soups, fish, and beef pemmican. Out of the 34 samples of preserved provisions of all kinds submitted to examination the condition of preservation of 29 was most satisfactory, the state of five only out of the number being unsatisfactory, three of these being vegetables. It is concluded on the whole that the several processes adopted for the preservation of vegetable and animal substances, so far as regards home and domestic use, are productive of satisfactory results. From the few cases, however, which have turned out unfavourably it is evident that the greatest care is requisite in conducting the several steps of whatever process is adopted.

The next report was devoted to the examination of Cayenne Pepper purchased at the establishments of grocers and oilmen resident in the metropolis, and the results were startling. Cinnabar, vermilion, or sulphide of mercury was detected in one sample. Six of the samples consisted of a mixture of ground rice, turmeric, and cayenne coloured with either red lead or a red ferruginous earth. Venetian red, red ochre, brick dust, occurred in seven samples, red lead in poisonous quantities in 13 samples, while of the 28 examined 22 contained mineral colouring matter. Practically the same substances and colouring agents were found in Curry Powder, the report, including the analysis of 26 samples, appearing in the "Lancet" of 17th July, 1852.

The next Commission dealt with Preserved Bottled Fruits and Vegetables. Twenty-seven samples out of 33 contained varying quantities of copper. This was true for gooseberries, rhubarb, and greengages, but not for red fruits like currants, raspberries, and cherries. Several specimens of green fruits and vegetables were free from copper. Olives contained a very large amount of copper. The colour of green fruit and vegetables is, the Commission remark, apparently heightened by a second device; the bottles in which they are enclosed are made of a highly-coloured glass; those in which French olives are preserved are so intense a green as to impart to the fruit a deep green colour even without the aid of copper.

The next enquiry of interest to the Committee related to Anchovies, in which red lead was occasionally found. In 23 out of 28 samples bole Armenian or Venetian red was found. Much the same class of colouring material was found in many samples of potted meats and fish, the report appearing in the "Lancet" of 13th November, 1852.

The next enquiry related to Sauces, in which apparently in some instances charred deal wood was used for imparting colour. Cochineal and bole Armenian were found in essence of lobsters, shrimps, and anchovies.

An interesting letter appeared in the "Lancet" of 15th January, 1853, from the late Dr. Bernays, Lecturer on Chemistry at that time in St. Thomas's Hospital. Referring to the work of the "Lancet" Analytical Sanitary Commission, Dr. Bernays records that when eating gooseberries with a steel fork he observed the prongs to be completely coated with a thin film of bright metallic copper.

Preserves and Jellies were next the subject of enquiry, the results being recorded in the "Lancet" of 22nd January, 1853. Some 35 samples were examined. Raspberry jam, gooseberry jam, greengage jam, the greengages of crystallised fruit, limes, and greengages, and candied citron peel, all owed their brilliant colour to a salt of copper.

The next subject forming the basis of a report was Lard, where the chief form of adulteration appeared to be caustic lime "to improve consistence and colour."

Later, in the "Lancet" of 4th June, 1853, it is shown that Butter is heavily preserved with an excess of salt, but no other preservative is mentioned.

A pause appears to have occurred at this date in the work of the Commission, the next article appearing in the "Lancet" of 3rd December, 1853, which related to the analysis of 43 samples of Snuff. In many instances red ochre, yellow ochre, and umber were found for colouring purposes. Chromate of lead, oxide of lead, and bichromate of potash were found in other samples.

In the following year, in the issue of the "Lancet" of 27th May, 1854, appeared a remarkable report on the "Colours used in Confectionery." Yellow sweets were found coloured with chromate of lead and gamboge; the red sweets were coloured with red lead, vermilion, or sulphide of mercury; the brown sweets were coloured with umber and sienna; the purple sweets with Prussian blue and cochineal; the blue sweets with indigo, Prussian blue, and ultramarine; the green sweets with Brunswick green, a mixture of chromate of lead and Prussian blue; and others were coloured with carbonate of copper and Scheele's green or arsenite of copper. In cake ornaments white lead was frequently found. In this report several instances are given of poisoning by the consumption of articles so coloured.

With this terrible indictment the work of the Commission as it relates to the subject of enquiry before the Committee on Preservatives ceased until seven years later. In 1861 and 1865 the Lancet Analytical Commission resumed its enquiry, and this time devoted its attention again to Preserved Provisions, in which it was shown that copper was still employed to a very large extent in green preserved fruits and vegetables, although the samples obtained from big firms which are still well known were shown to be free from copper. Also it was shown that the gross forms of adulteration of Cayenne, as with lead and mercury, had to a large extent subsided. In the same year it was also shown that Mustard was less adulterated, and that turmeric as a colouring agent was the exception rather than the rule. There is a vast amount of further information in these reports bearing on the general adulteration of food up to that time. It would clearly appear that up to this date the present methods of preserving and colouring foods were unknown. That attempts were, however, very strenuously made to institute a satisfactory method for the preservation of food is abundantly clear from a perusal of the "Lancet" from 1854 to 1886. Editorial articles appeared again and again as to the merit of certain processes, and analyses were quoted clearly emanating from the "Lancet" Analytical Sanitary Commission, dealing with the product of these methods. It is interesting to refer to one article, which appeared in the "Lancet" of 19th January, 1867.

In this article the efforts that have been made towards preserving Animal Food Supplies are described. Omitting to mention the methods of tinning meats in vacuo we may refer for the purposes of the present enquiry to the section of this article which deals with antiseptics. It would appear that sulphurous acid and the sulphites were tried, with the result that though to some extent the meat was preserved from putrefaction, yet the flavour of the meat so treated put the method out of court. The use of nitric oxide was also suggested. In summing up the "Lancet" writes, "It may be safely asserted that no method is known to science by which the decomposition of raw meat can be prevented, especially in tropical climates, without the employment of some powerful antiseptic which, in order to accomplish the object, must impregnate every part of the meat and its juices. It may also be safely asserted that there are no known antiseptics capable of producing the required effect that would not either destroy the nutritive properties of the meat or communicate to it a decided flavour that would interfere with its use as a food. Salt is the only chemical agent that has been used with any good effect, but something better than salt meat is wanted." Here again there is no mention of the use of modern antiseptics like borax.

Apparently the first mention of a modern preservative in Milk was in the "Lancet" of 20th January, 1877. The preservative was salicylic acid. Next, in the same journal of 11th January, 1879, borax is mentioned as being used in meat.

It is curious to note that the employment of modern antiseptics for the preservation of food was introduced much about the time when Lord Lister introduced his method of antiseptic treatment. Lord Lister's discovery was made in 1870, and in the following years the Listerian methods were adopted, with what remarkable results in the history of medicine every medical man knows.

In 1886, Vol. I., page 700, an editorial note appears in the "Lancet" on the "Increasing Use of Preservatives in Food." Benzoate of soda appears then to have been regarded as the best agent. Boric acid is described as undesirable and injurious, especially when present in milk for infant use.

In another article, which appeared on p. 1142, Vol. II., 1886, the results of the examination of Borated Fish are reported. Here it is stated that apparently boric acid is not truly a preservative, and blackening of the flesh was noticeable.

Then, in several articles which appeared in the second volume of the "Lancet" in 1887, the increasing use of Boric Acid in Milk was pointed out, and appeal was made for attention to the subject. One of these articles was the translation of Dr. Forster's Report in Dingler's "Polytechnisches Journal," 1884, page 170, on the use of boric acid as a so-called food preservative. This will be found to be a very interesting physiological enquiry, which would appear to have anticipated modern experiments. The result was distinctly unfavourable to the use of boric acid.

The publication of this article in the columns of the "Lancet" led to what must be regarded as the first public agitation on the subject. It received considerable comment at the hands of the public analysts, which culminated in the first case of prosecution instituted under the Sale of Food Acts. The case failed on the point of an added, and as it was urged, injurious preservative, but succeeded on the point of abstraction of fat.

In a leading article in the "Lancet" of 10th January, 1891, in commenting upon this case, the "Lancet" remarked that the "question is an important one and calls for immediate investigation, and the consensus of medical opinion must be gained."

This is exactly the present position, and a position which the Committee are appointed to elucidate. As to the evidence of the use of preservatives and colouring matters in food following the date of this remark (10th January, 1891) up to the present time, particulars have already been furnished to the Committee by medical men, public analysts, and myself.

The "Lancet" Laboratory,
29th November, 1899.

APPENDIX No. XI.

Handed in by Mr. *T. Carrington Smith* on Wednesday, January 17th, 1900.

TABLE A.—STATEMENT giving NAMES of PRESERVATIVES used in various descriptions of Dairy Produce, and the quantities or proportions in which they are used by persons who have complied with a request for information on the subject.

No.	Farmer, Dairyman, or Dairy Factory.	Preservative.	Used for.	Quantity or Proportion in which used.	Remarks.
1	Dairy factory	Borax and boracic acid	Butter and cream	$\frac{1}{2}$ to $\frac{3}{4}$ per cent. Smaller quantities would not answer. Mixture consists of Borax 50 per cent., boracic acid 40 per cent., salt 10 per cent.	Prohibition would kill English butter and cream trade.
2	Dairyman	Formaldehyde	Milk	1 part in every 20,000 parts	Prohibition would injure business.
3	Dairy factory	Glacialine	Milk	1 oz. to 18 imperial gallons	Used occasionally.
		Glacialine	Potted cream	1 oz. to 5 imperial gallons of cream.	
		Boracic acid	Milk and cream	Does not preserve so well, therefore adds twice as much to be effective.	
4	Dairyman	Glacialine	Milk	2 oz. to 16 gallons.	
		Arcticanus	Cream.		
5	Dairyman	Formalin	Milk	$\frac{1}{2}$ pint of 3 gallon solution in 16 gallon churn.	
		Preservitas	Cream	With 7 lb. of sugar added to 14 lb. of powdered preservitas, 1 oz. in 20 quarts.	
6	Farmer	Borax	Milk	1 oz. to 50 gallons	Only used about one month in the year.
7	Dairyman	Arcticanus	Cream	April to September $\frac{1}{4}$ oz. per gallon, October to March $\frac{1}{8}$ oz. per gallon.	Prohibition would cause serious loss and waste of valuable dairy products.
8	Dairyman	Preservitas	Butter	1 per cent.	
9	Dairyman	Douglas's dry antiseptic	Milk, cream and butter	2 oz. to 30 gallons of milk.	
10	Dairyman	Formalin	Milk	1 in 20,000	In bad weather only.
		Glacialine	Cream	As directed.	
11	Dairy factory	Special cream preservative	Potted cream	2 oz. to 3 gallons of cream	Total prohibition would be a distinct advantage in West of England.
12	Farmer	Boracic acid or a mixture of borax and boracic acid.	Cream	1 oz. of boracic acid or a mixture of $\frac{1}{4}$ oz. borax and $\frac{3}{4}$ oz. of boracic acid.	
13	Farmer	Boracic acid	Milk	Small quantity.	
14	Dairy factory	Coverdale's Milk and Meat Preserver.	Cream	10 grammes per gallon	Abolition of preservatives in cream would ruin business which is chiefly in fresh cream.
15	Dairyman	Glacialine	New milk	1 oz. to 6 imperial gallons.	
		Formalin	Separated milk	5 oz. to 7 gallons.	
		Glacialine	Butter	1 lb. to 112 lb. of butter.	
16	Dairy factory	Mitchell's Preservative	Milk	2 oz. to 16 gallons	Used only in hot weather.
		Mitchell's Preservative	Separated milk	2 oz. to 16 gallons	Used only in hot weather.
		Preservitas	Cream	$\frac{1}{2}$ teaspoonful to 1 gallon.	
17	Dairyman	Crown	Milk	2 oz. to 16 gallons.	
		Crown	Cream	$\frac{1}{2}$ lb. to 16 gallons	Would be almost useless without preservatives.
		Crown	Butter	$\frac{1}{4}$ lb. to 100 lbs,	

TABLE A.—STATEMENT giving NAMES of PRESERVATIVES used in various descriptions of Dairy Produce, &c.—*continued.*

No.	Farmer, Dairyman, or Dairy Factory.	Preservative.	Used for	Quantity or Proportion in which used.	Remarks.
18	Farmer	Crystaline	Milk	1 tablespoonful to 17 gallons	Prohibition not injurious if applied all round.
19	Dairy factory	Borax	Butter		
20	Dairyman	Middleton's antiseptic	Milk	1 lb. dissolved in 8 gallons of water; 1 pint of solution to 8 gallons of milk.	Impossible to carry on milk trade in hot weather without preservative.
		Middleton's antiseptic	Cream	A little dry powder.	
21	Dairy factory	Special cream preservative	Cream	1 oz. per gallon	Prohibition would greatly injure business.
22	Farmer	Boracic acid	Milk	2 oz. to 17 gallons in 1896	Sends milk twice daily, and does not now receive preservative from dealer.
23	Dairyman	Formalin	Milk	1 in 20,000.	
		Glacialine and Arcticanus	Cream		
24	Dairy factory	Preservitas	Cream	Variable	Sent by purchasers.
25	Dairyman	Boracic acid and borax	Milk	1 oz. dry to 16 gallons.	
26	Dairyman	Conservine	Milk	⅛ oz. to the gallon.	
		Arcticanus	Cream	½ oz. to the gallon.	
27	Dairyman	Golden Cross brand	Cream	½ oz. to 1 oz. to each imperial gallon of cream.	
28	Dairy factory	Preservitas	Cream	½ oz. to 1 oz., according to season	Prohibition would absolutely ruin cream trade.
		Arcticanus	Butter	½ per cent.	Only used occasionally.
		Sal preservare	Milk		Only used on exceptional occasions.
29	Dairyman	Preservitas	Milk and cream	3 quarts of liquid preservative to 60 gallons of milk.	
30	Farmer	Preservative sent by dealer	Milk	1 teaspoonful to 4 gallons of milk.	
31	Farmer	Boracic acid	Milk	Dessertspoonful to 17 gallon churn.	
32	Dairy factory	Crystalline	Milk	1 oz. to 8 gallons	Only in hot weather.
		Crystalline	Cream	1 oz. to 4 gallons	At all times. Prohibition would put an end to sale of cream for table use.
33	Dairy factory	Salt and saltpetre	Cheese, milk, cream and butter	1 oz. of saltpetre to 20 gallons of milk or cream	Only in hot weather.
34	Dairy factory	Arcticanus	Butter	1 per cent.	
		Arcticanus	Cream	Not more than 5 per cent.	
35	Farmer	Formalin	Milk	½ oz. to 17 imperial gallons.	
	Farmer	Boracic acid	Separated milk	1 oz. to 17 imperial gallons.	
		Formalin	Cream	Same as milk.	
36	Farmer	Arcticanus	Milk and cream	2 oz. to 17 gallons	In hot weather.
37	Farmer	Mitchell's Preservative	Butter	According to instructions and judgment of dairymaid	Prohibition would be injurious unless universal.
38	Dairy factory	Preservitas	Cream	¾ oz. to 1 imperial gallon.	
		Preservitas	Milk	2 oz. to churn of 17 gallons	Only in very hot weather.
39	Dairyman	Arcticanus	Cream	½ oz. to 3 gallons of cream.	
40	Dairyman	Arcticanus	Cream	½ oz. to ¾ oz. to 3 gallons cream.	
41	Farmer	Saltpetre	Butter	¼ oz. to 1 lb. of butter.	
42	Farmer	Salt and saltpetre	Butter	1 lb. salt and 1 dessertspoonful of saltpetre to 20 quarts of cream.	
43	Farmer	Arcticanus	Cream	¾ oz. to 1 gallon of cream	In the hottest weather.
		Arcticanus	Butter milk	Small quantity only.	

N.B.—Numbers 44 to 65 are the replies of London and Suburban Dairymen.

44	Dairyman	Glacialine and Preservitas	Milk	1 oz. to 17 gallons; rather more in extremely hot weather.	Impossible to carry on milk business without preservatives.
45	Dairyman	Arcticanus	Milk	1½ pints to churn of 16 imperial gallons, equal to 1½ oz. powder.	Impossible to carry on dairy trade without it.
46	Dairyman	Glacialine	Milk and cream	- - - - - - - - - - -	Impossible to keep cream sweet in summer without it.
47	Dairyman	Arcticanus	Milk.		
48	Dairyman	Arcticanus Glacialine	Milk and cream Milk and cream.	2½ oz. to 18 imperial gallons of milk	Impossible to carry on dairy industry without preservatives.
49	Dairyman	Formalin	Milk	As recommended by manufacturers.	
50	Dairyman	Boracic acid	Milk	2 oz. to 16 imperial gallons	Use of preservatives essential.
51	Dairyman	Lac Pottass	Milk	½ gill to 8½ barn gallons	Only during one month in year.
52	Dairyman	Borax and boracic acid	Milk	Equal portions mixed, 2 oz. to 17 imperial gallons.	
53	Dairyman	High price preservative guaranteed not to contain borax.	Milk	- - - - - - - - - - -	Considers some preservatives necessary.
54	Dairyman	Arcticanus	Milk	1 gill of dry powder to a churn.	
55	Dairyman	Formalin Glacialine Glacialine	Milk Butter Cream	Rather less than advertised quantity. 1 oz. to 10 lbs. 1 oz. to 6 imperial gallons	Prohibition would do enormous harm; half the milk coming to London would have to be kept at home.
56	Dairyman	Seima (made of boracic acid)	Cream	Very carelessly used, quantity regulated by individual's idea of requirements.	Difficult if not impossible to keep cream without preservative. As regards milk, preservatives have been discarded, because it was found that by selecting first-class dairies and attention to feed and cooling, preservatives can be done without.
57	Dairyman	Preservitas	Milk	1 pint to every 8 gallons (of 8 quarts to gallon).	
58	Dairyman	Preservitas	Cream	Smallest quantity mentioned on tins.	
59	Dairyman	Schering's Formalin solution	Milk	1 gill to 17 imperial gallons	Used during 3 or 4 months of hot weather.
60	Dairyman	Boracic acid	Milk	1 oz. to 16 imperial gallons.	
61	Dairyman	Glacialine	Milk	1 dessertspoonful to 16 imperial gallons.	
62	Dairyman	Preservitas	Cream	1 oz. to 4 gallons	Other preservatives given up, some for bad taste when over one day old, others for spoiling flavour.
63	Dairyman	Glacialine Arcticanus Formalin	Milk Cream Butter	Diluted with water as directed by makers.	
64	Dairyman	"Freezall" Arcticanus	Milk Cream	1 oz. to 18 gallons during hot weather. ½ oz. to 4 quarts „ „	
65	Dairyman	Boro	Cream.		

APPENDIX No. XI.—*continued.*

TABLE B.—STATEMENT giving Names of COLOURING MATTERS used in various descriptions of Dairy Produce and Quantities or Proportions in which they are used by Persons who have complied with a request for information on the subject.

No.	Farmer, Dairyman, or Dairy Factory.	Colouring Matter.	Used for.	Quantity or Proportion in which used.	Remarks.
1	Dairyman	Annatto	Butter and milk	1 in 15,000.	
2	Farmer	Annatto, (Fullwood's)	Cheese	Tablespoonful to 28 gallons of milk	A loss if not able to colour.
3	Dairy Factory	Annatto, (Nicholls', Hansen')	Cheese	1 dram to 3 gallons. (Leicester cheese), 1 dram to 4 gallons (Cheddar cheese).	Milk coloured occasionally, but do not consider it necessary.
		Hansen's Butter Colour	Butter	Quantity varies according to district.	
–	Farmer	Primrose Butter Colouring	Butter	$\frac{1}{2}$ oz. to 12 lbs.	Only used about one month in year.
4	Dairyman	Annatto, special preparation in finest Arachide oil.	Butter	$\frac{1}{4}$ oz. to 8 gallons of churning cream	Only used in winter.
6	Dairyman	Annatto	Butter.		
7	Farmer	Annatto, (Fullwood and Bland's)	Cheese and butter	Varies according to time of year and feeding of cattle.	
8	Dairyman	Silver Churn	Butter	Sufficient to give butter a saleable appearance	Value affected by over or under colouring.
9	Dairyman	Annatto, (Fullwood and Bland's)	Milk, cream, and butter	$\frac{1}{2}$ teaspoonful to 30 gallons of milk.	
10	Dairyman	Danish butter colouring	Butter	As required to remove the lardy whiteness	In spring only.
11	Farmer	Carrotine, (Dunn's)	Butter	Tablespoonful to 20 quarts of cream.	
12	Farmer	Hansen's Danish colouring	Butter	Tablespoonful to 5 gallons of cream	Some customers will have high-coloured butter.
13	Farmer	Annatto	Butter	2 teaspoonfuls to 50 quarts of cream for butter	In winter, butter very pale without colouring.
		Annatto	Cheese	1 dram to 10 gallons of milk for Cheshire cheese	Some people like coloured cheese.
14	Dairyman	Silver Churn	Butter	Never more than 1 gill to 34 gallons of cream. Quantity varies according to time of year.	
15	Dairy Factory	Hansen's Danish butter colouring.	Butter	About 2 oz. to 20 quarts of cream	Only used about two months in year.
16	Dairyman	Silver Churn	Butter	Depends upon natural colour of milk, which varies considerably.	
17	Farmer	Annatto	Butter	1 teaspoonful to 16 gallons of cream	Public object to pale-coloured butter.
18	Farmer	Annatto (Van Hassel's Fluid Extract).	Cheese	1 oz. to 50 gallons of milk	Cheshire farmers made a trade by colouring cheese. Considers that other countries should not be allowed to colour their cheese like Cheshire cheese.
19	Dairy Factory	Silver Churn	Butter	Guided by tint of butter, which to sell must be of bright straw colour.	
20	Dairyman	Annatto (Middleton's)	Milk	Teaspoonful to 17 gallons	Has been in trade as retailer 25 years. First two years colouring not used; considers separated or skimmed milk should not be coloured.
21	Farmer	Howarth colouring fluid	Milk	$\frac{1}{2}$ dram to 5 dozen.	
22	Farmer	Oleo Butter Colourine	Butter	Very little; "just to give it a little colour when cows are old-milched."	Prohibition would not injure milk or butter sale, but would be detrimental to sale of Cheddar and Cheshire cheese.
23	Dairyman	Annatto	Cream.		
24	Dairyman	Annatto	Milk	$\frac{1}{3}$ to 1 teaspoonful per churn of 17 imperial gallons	Varies according to colour inhabitants of different districts suppose milk to possess.
25	Farmer	Annatto	Butter	Only a few drops sometimes	Scarcely any butter sold.

Appendix.

26	Dairy Factory	Oleo butter colour (Fullwood and Bland's).	Butter	About 1 teaspoonful to every 4 gallons thick cream	In some districts pale coloured butter is unsaleable.
		Tomlinson's butter colour	Butter	1½ teaspoonful to 4 gallons of thick cream	
27	Dairyman	Primrose colouring	Milk and cream	Small eggspoonful to 60 gallons milk.	
28	Farmer	Danish butter colouring	Butter	1 teaspoonful to 20 lbs. of butter.	
29	Farmer	Annatto	Cheshire cheese	About 2 oz. to 50 gallons of milk.	
30	Dairy Factory	Annatto extract	Cheese	1 oz. to 100 gallons of milk.	
		Annatto extract	Butter	1 oz. to 30 or 40 lbs. of butter.	Only during winter. Uncoloured butter and cheese unsaleable.
31	Farmer	Cowslip colouring	Milk	½ dram to ½ dozen of milk	Does not consider colouring essential; should be sold in natural state.
32	Farmer	Grated carrots	Butter.		
33	Dairy factory	Annatto	Cheese, milk, cream, and butter	Amount of colouring makes no difference except in appearance.	
34	Dairy factory	Annatto	Butter and cream.		
35	Farmer	Annatto	Butter and cheese	Small quantity.	
36	Farmer	Annatto	Butter and cheese	2 oz. to 100 lbs. of curds.	
37	Farmer	Annatto and oil	Butter	Variable.	
38	Farmer	Annatto	Milk and butter	½ teaspoonful to 17 gallons.	
39	Farmer	Silver Churn	Butter	According to makers' instructions and judgment of dairymaid.	
40	Farmer	Jersey butter colouring	Butter	Teaspoonful to 6 quarts of cream.	
41	Dairyman	Extract of Annatto	Milk	Teaspoonful to 17 gallons of milk	Seldom used.
42	Dairy factory	-	Cheese and butter	According to requirements of district.	

N.B.—Numbers 43 *to* 64 *are the replies of London and Suburban Dairymen.*

43	Dairyman	Colouring XXX.	Milk	¾ teaspoonful to churn.	
44	Dairyman	Annatto	Milk	Smallest quantity necessary to please customers.	
45	Dairyman	Annatto	Milk	1 teaspoonful to 17 gallons milk.	
46	Dairyman	Annatto	Milk	1 teaspoonful to every 16 gallons	Public will not have it uncoloured.
47	Dairyman	Annatto	Milk and cream	¼ of a gill to 108 imperial gallons.	
48	Dairyman	Annatto	Milk	As recommended by manufacturers.	
49	Dairyman	Annatto	Milk	1 thimbleful to 8 imperial gallons.	Do dairyman great harm to prohibit colouring.
50	Dairyman	Extract of Annatto	Milk	½ gill to 16 barn gallons.	
51	Dairyman	Annatto	Milk	-	If public did not demand it, colouring would not be used.
52	Dairyman	Buttercup colouring	Milk	Teaspoonful for churn.	
53	Dairyman	Annatto	Milk	60 drops to 17 gallons.	
54	Dairyman	Annatto	Milk.		
55	Dairyman	Annatto	Milk	Teaspoonful to every 17 imperial gallons	Considers prohibition of colouring in milk would injure whole trade.
56	Dairyman	Annatto	Milk	Small teaspoonful for 18 imperial gallons	Public should be taught that milk is white except in spring.
57	Dairyman	Annatto	Milk	Dessertspoonful to 17 imperial gallons milk.	
58	Dairyman	Annatto	Milk	Teaspoonful to 16 imperial gallons.	
59	Dairyman	Annatto	Milk	Teaspoonful to 17 imperial gallons milk.	
60	Dairyman	Annatto	Milk	Teaspoonful to 17 imperial gallons.	
61	Dairyman	Annatto	Milk	Teaspoonful to 10 or 12 gallons.	
62	Dairyman	Annatto	Milk and cream	2 drops to 18 gallons milk, only during winter months.	
63	Dairyman	Cowslip	Milk	2 to 3 drops per imperial gallon	2 drops in summer, 3 in winter.
64	Dairyman	Annatto	Milk		

Table C.—STATEMENT giving the Names of the Preservatives mentioned in 110 Replies to a Circular Letter addressed to Dairy Farmers and Traders, with the Number of Persons using each.

Name of Preservative.	Used by Persons.	Name of Preservative.	Used by Persons.
Arcticanus	Sixteen.	Coverdale's Milk and Meat Preserver	One.
Borax or boracic acid	Thirteen.	Middleton's Antiseptic	One.
Glacialine	Eleven.	Conservine	One.
Preservitas	Eleven.	Golden Cross Brand	One.
Formalin (including one described as Schering's Formalin Solution).	Nine.	Sal preservare	One.
		Crown	One.
Salt and saltpetre	Three.	Seima	One.
Crystalline	Two.	"High-priced Preservative, warranted not to contain Borax."	One.
Special Cream Preservative	Two.		
Mitchell's Preservative	Two.	Lac pottass	One.
Formaldehyde	One.	"Freezall"	One.
Douglas's Dry Antiseptic	One.	"Boro"	One.

Table D.—STATEMENT giving the Names of the Colouring Matters mentioned in 110 Replies to a Circular Letter addressed to Dairy Farmers and Traders, with the Number of Persons using each.

Name of Colouring Matter.	Used by Persons.	Name of Colouring Matter.	Used by Persons.
Annatto	Forty-two.	Howarth Colouring Fluid	One.
Danish Butter Colouring	Five.	Tomlinson's Butter Colouring	One.
Silver Churn	Five.	Grated carrots	One.
Primrose Butter Colouring	Two.	Colouring XXX.	One.
Oleo Butter Colourine	Two.	Jersey Butter Colouring	One.
Cowslip Colouring	Two.	Butter Cup Colouring	One.
Carrotine	One.		

Copy of a Resolution passed at the Annual General Meeting of the Central Chamber of Agriculture, held on December 6th last, on the motion of Mr. S. Kidner, representing the Taunton Farmers' Club, seconded by Mr. C. Middleton, representing the Cleveland Chamber:—

> "That this Meeting is opposed to the employment of preservatives and colouring matters in articles of dairy produce, whether British or imported; and that it be an instruction to the witnesses appointed by this Chamber to give evidence before the Departmental Committee to urge that, as preservatives and colouring matters are believed to be deleterious to the health of invalids and children, their use should be prohibited."

APPENDIX No. XII.

Appendix.

Handed in by Mr. W. W. Fisher, January 17th, 1900.

Report expressing the general experiences of the members of the Society of Public Analysts.

Since my former communication to your Secretary, I have been able to gather further information, which I have the honour to submit to the Committee.

A schedule of articles of food and drink, prepared by the Society of Public Analysts, was sent to members with the request that they would furnish any information they could in regard to the use of preservatives and colouring matters, and a number of analysts have kindly contributed the results of their experience. Through the kindly co-operation of the authorities for whom I act, many articles have been purchased for analysis, which have been specially examined in view of this enquiry, but although this assists in filling up some gaps, it will be seen that much remains to be done in respect of a large number of articles.

It will probably be convenient to classify the articles in five groups:—

I.—Fresh meat, etc., preserved meat, fish.

II.—Dairy products.

III.—Vegetables, fruit, confectionery.

IV.—Beverages, alcoholic and non-alcoholic; sauces, condiments.

V.—Drugs and vegetable extracts.

I.—FRESH MEATS, ETC.

Fresh Meats.—Beef, mutton, pork, veal, venison, poultry, game.

Potted and Prepared Meats.—Dried Meats, meat powders and biscuits, sausages, bacon and ham, salt beef, salt pork, smoked meats, meat extracts, meat juices, soups, tinned and potted meats, jellies.

Many of these articles are never purchased for analysis, and no information is available either as regards the use of preservatives or artificial colouring.

Sausages.—These articles are frequently coloured. In the North of England Mr. Allen of Sheffield finds Congo red is used very generally; Mr. Keating Stock (Durham) has met with a mixture, parts of borax and boric acid coloured with Congo red, which is used as a preservative for meats. Mr. J. W. Gatehouse, of Bath, states that species of eosine dye, known as "theodine," is largely used, and he has advised its discontinuance, as it is likely to be injurious to health. Mr. Bodmer (Southwark) has met with red colouring matter, probably an anilyne dye. In the Oxford district a small proportion of red oxide of iron is used sometimes as a colouring in German sausage, but the red appearance is mainly due to the presence of saltpetre in the brine used for salting; the red colour is occasionally enhanced by artificial dye upon the outside skin of the sausage.

A boracic preservative is not infrequently used. Dr. A. Hill records it in sausages and in German sausage, and in polony he has found ·65 per cent. boric acid; in chicken, ham and tongue ·6 per cent.

Of five makes of German sausage lately examined I found three containing boracic acid in the proportion of ·45 per cent. H_3BO_3; ·34 per cent. and ·37 per cent. severally.

Dr. Dyer has detected in pork sausages quantities up to ·7 per cent.

Bacon and Ham.—Mr. Gatehouse says borax is largely used for hams. "Curers assert public taste requires this treatment, and the old salt and saltpetre pickle will not sell, and besides is much too long in operation. The latter, it may be presumed, is the true reason. Impure calcium sulphite mixed with much sulphate was offered to a large bacon curer for rubbing into sides of bacon, but it is not known if this was actually used."

Dr. Bernard Dyer states that out of 34 samples of bacon and ham submitted to him because suspected, 14 contained boracic acid; one ham contained from ·5 to ·75 per cent. in different parts.

Dr. A. Hill has found bacon to contain ·4 per cent. boric acid, ham ·15 per cent., and salt beef ·45 per cent. of boric acid.

Dr. Rideal gives ·04 per cent. of borax as the amount in American ham, and several other gentlemen mention the presence of boracic preservatives in bacon and ham. I am informed that "A Manual of the Pork Trade" was published by L. Upcott Gill (170, Strand, London) by Mr. M. L. Douglas, but is now out of print, and I have not yet seen a copy. It contains recipes for all sorts of sausages, pork pies, etc., as well as information about bacon curing, and would doubtless afford much information to the Committee. As an ingredient of almost everything, "dry antiseptic," which is a mixture of borax and boracic acid, is recommended, usually in the proportion of about ½ per cent.

In respect of meat extracts I have little information, but Mr. Allen has met with boric acid in one make. Mr. Clayton also mentions its presence, while Mr. R. Bodmer states that 9 per cent. of boracic acid was present in a liquor used for pickling livers. I have recently examined samples of tinned salt beef, tinned rabbit, potted meat, and potted beef, but no preservative beyond salt and saltpetre was discovered. Dr. A. Hill has met with boracic preservatives in pork pie, salt beef, and pickled tongue, and my colleague, Dr. T. Stevenson, informed me that borates are used for venison, poultry, bacon, ham, as well as for salt pork, salt fish, and fresh fish.

Meat juices sometimes contain glycerine.

Table jellies lately examined were free from preservatives, but some contained artificial dyes, a diazo yellow and a red.

Fish.—Mr. Allen has observed much boracic acid in herring brine, and Dr. Hill has found this preservative in salt fish.

In tinned lobster recently examined I found no preservative beyond a little salt; in bloater pastes I have found the ash, mainly consisting of salt, varied from 15·9 per cent. to 9·8 per cent., but in one sample was only 6·5 per cent.; this was a tinned article. No boracic acid was present in any case. Four specimens out of six examined contained red oxide of iron (probably ochre or Armenian bole) as a colouring matter; the proportion of ferric oxide determined ranged between ·34 per cent. to ·05 per cent.

An anchovy paste contained 17·4 per cent. ash, nearly all salt, a little oxide of iron, and traces of a sulphite preservative.

Two samples of smoked fish examined by Dr. Dyer were free from boracic acid.

One of our members, Mr. Henry Leffmann, of Philadelphia, sends the following information as to the composition of meat preservatives, from the report of a local board of health:—

(1) Solution of Calcium Sulphite.

(2) Conserve for Sausages.

Potassium Nitrate - -	33·5 grammes.
Boric Acid - - - - -	27·5 „
Glycerol - - - - -	50·0 „

(3) Preserving Salt.

Borax - - - - - -	48·5 per cent.
Sodium Chloride - - -	3·5 „
Sodium Bicarbonate - -	9·1 „
Water - - - - - -	39·0 „

(4) Ham Preserver:

Potassium Alum. - -	70·0 grammes.
Potassium Nitrate - -	21·0 „

Some of these meat preservatives contain a coal-tar dye to assist in reddening the meat.

Appendix.

Mr. J. Hendrick (Aberdeen) sends the analysis of a liquid intended to be sold as a preservative for fish; it contained 1·37 anhydrous boron oxide, a little glycerine, and ·5 per cent. common salt. The total solids were 3·29 per 100 c.c.

Mr. H. Droop Richmond, analyst to the Aylesbury Dairy Company, Limited, who has examined a number of commercial preservatives, has most kindly furnished the following particulars of their composition:—

ANALYSIS OF COMMERCIAL PRESERVATIVES.

	Mixtures of Borax and Boric Acid.			Calculated as	
	B_2O_3	$Na_2B_4O_7$	Total B_2O_3	H_3BO_3	$Na_2B_4O_7, 10H_2O$
1	56·6	—	56·6	100·3	—
2	51·9	4·1	54·8	91·9	7·7
3	51·6	7·6	56·9	91·5	14·4
4	47·5	12·0	55·8	84·1	22·7
5	42·6	15·15	53·1	75·5	28·6
6	44·65	20·1	58·55	79·1	38·0
7	43·5	21·0	58·05	77·0	39·7
8	42·1	21·7	57·1	74·6	40·2
9	42·5	23·8	59·0	75·2	45·0
10	39·5	26·8	58·1	70·0	50·7

Average, 56·8 per cent. of B_2O_3.

He has also met with a preservative containing a mixture of borax and boric acid, with about 5 per cent. of salicylic acid.

Another preservative analysed contained boric acid equal to 7·46 B_2O_3 or 13·25 per cent. H_3BO_3, and combined salicylic acid 12·87. The ash contained a little calcium, much magnesium and sodium. Glycerol was found in large quantity, and an unidentified bitter principle, probably to mask the taste of glycerol, was present. The alkalinity of the ash corresponded with the quantity of salicylic acid.

This preparation consisted essentially of a solution of boric acid and sodium or magnesium salicylate in glycerol.

II.—DAIRY PRODUCTS.

Milk, new, skimmed or separated, condensed; butter milk; cream, new, and in pots; Devonshire cream, butter, margarine; cream cheese, fancy cheeses, English cheese, imported cheese, margarine or filled cheese; junket.

The testimony as to the use of preservatives in milk and some other dairy products is universal, but in different parts of the country the extent to which the practice is adopted is variable, and I will briefly mention the experiences of my colleagues, which they have furnished.

Mr. A. H. Allen, of Sheffield, Analyst to the West Riding of Yorkshire, etc., states that formalin and boric acid are found in milk, the latter up to 1 per cent.; the boracic acid is also used with cream in pots, butter, and margarine, up to the same limit.

Dr. Bernard Dyer, of London, Analyst for the counties of Leicester, Rutland, and Wilts, etc., informs me that out of 270 milks recently examined for boracic acid, only one sample contained it; and adds that these are country retailed milks. Further, out of 234 samples of butter, 30 contained boracic acid ranging from 0·03 per cent. to 1·35 per cent., but it is rare to find more than 0·75 per cent.

Of 30 samples—

8 gave 0·25 per cent. or less.
12 ,, 0·26 ,, to 0·50 per cent.
7 ,, 0·51 ,, to 0·75 ,,
1 ,, 1·06 ,,
1 ,, 1·35 ,,

In Dec. 1899 seven butters were purchased under the Act in Oxford, and boracic preservative was present in four up to 1·2 per cent. of H_3BO_3.

The use of the preservatives is also noted by the Analyst for Shropshire, Montgomeryshire, Merionethshire (Mr. T. P. Blunt), Mr. Harvey, of Canterbury, etc., who meets with boracic compounds occasionally, but thinks they are less used than three years since. Mr. J. W. Gatehouse, of Bath, says boric acid compounds and borax are largely used; Formalin rarely in that neighbourhood. "The hospital authorities in Bath believe that boric compounds are seriously injurious to their patients."

Mr. Hendrick, of Aberdeen, records that borax and boric acid are used in milk and butter, but only to a limited extent, in the district. He found in a recent case that glacialine contained 58 per cent. of anhydrous B_2O_3; also alkali corresponding to 28 per cent. of borax. Anatto is used for colouring.

Dr. Alfred Hill, of Birmingham, has met with boric acid in milk, etc., in the following quantities:—

Milk - - -	up to 0·18 per cent.
Separated Milk -	,, ·04 ,,
Cream in pots -	,, ·3 ,,
Clotted Cream -	,, ·35 ,,
Butter - - -	,, 1·6 ,,
Margarine - -	,, 1·1 ,,

Formic aldehyde in milk and salicylic acid in cream are also reported by him.

Mr. W. F. Lowe, of Chester, Public Analyst for Flint, Carnarvon, Denbigh, etc., finds the following proportions of boric acid:—·07 per cent. in new milk, ·27 per cent. in cream in pots, and in butter, ·10 per cent. to ·71 per cent.

Dr. S. Rideal, Analyst for the Lewisham district, has found in cream purchased under the Act, ·35 per cent. boric acid; in butter, ·136 per cent.; in margarine, ·48 per cent. (as crystallized borax); and in private samples of butter ·286 per cent. of boric acid. Imported butter: sometimes formaldehyde in centre of tub of butter, and boric acid on surface, used in wrapping paper.

The cream in pots sold in Newcastle-upon-Tyne contains boracic acid from ·05 to ·31 per cent.

The analyst for Durham County, Mr. Keating Stock, also records the use of borates, and Dr. Stevenson, Analyst for the counties of Surrey and Bedford, observes that borates and formaldehyde are used for new milk and tropæolins to colour; also in separated milk; while cream in pots, butter, and margarine are similarly preserved with borates. Dr. Stevenson states also that borates are used on the outside of imported cheese to keep off insects.

On the authority of Mr. H. Leffmann, of Philadelphia, I learn that paraffin and glucose are sometimes used in butter substitutes.

I should like to call the attention of the Committee to a table in the "Analyst" for June, 1899, by Mr. E. G. Clayton, from which it would appear that the use of boracic preservatives has declined in recent years in some parts of London.

I may add to the facts already communicated to your Committee that during the past quarter I have examined 29 milks from Buckinghamshire and Oxfordshire, none of which contained preservatives, but two samples of new cream sold in Oxford, of which complaint was made, were found to contain boracic preservative, in one instance upwards of 1 per cent. of the acid. I subsequently learned that this cream came from a dairy company in Dorsetshire.

Mr. H. Droop Richmond, analyst to the Aylesbury Dairy Company, has kindly sent us a statement on the subject of dairy products which is extremely valuable. He says, "In submitting the following list it must be understood that most of the information is derived from analyses and enquiries made without any special object in view;" and that he has little or no experience in the use of preservatives on a commercial scale, as the Aylesbury Dairy Company have always been antagonistic to their use; and that he has only a small amount of information, chiefly hearsay, of what is done by the trade generally.

The following substances are extensively treated with preservatives:—

Milk, new.

Milk, condensed (unsweetened), occasionally.

Milk, skimmed or separated, chiefly because the milk used for their preparation is preserved.

Appendix.

Cream, new. Cream in pots universally.

Devonshire cream (when sold in pots).

Butter. Margarine sometimes.

The following are not usually preserved:—Butter milk, cream cheese, fancy cheese, English cheese, margarine cheese, and imported. Preservative would probably never be resorted to, as it would prevent the ripening of the cheese. Junket may occasionally contain preservatives if prepared with milk containing them.

Substances used: Boric acid, borax, or usually mixtures of the two are used in milk, cream and generally in butter. A solution of formaldehyde ("formalin") containing 1 per cent. is extensively used for preserving milk and cream, and less frequently butter. Benzoates, salicylic acid, and salicylates, sodium floride, sodium fluosilicate, fluoboric acid, and fluoborates and potassium nitrate are among substances which have from time to time been used, but are probably but little employed.

The quantities used are as follows:—

Boric preservative in milk, ·05 to ·1 per cent.; in cream, ·05 to ·25 per cent.; in butter, ·1 per cent., when the butter is washed with the solution, or ·5 to 1 per cent.

Formalin is used in the proportion of one part of formaldehyde per 200,000 in milk, and from this to double the amount in cream.

The boric preservative added to cream is usually the "special cream compound," which, in addition to boric acid and borax, may contain sugar to sweeten the cream and thickening substances.

Mr. Richmond makes the following comments also: "The object of preserving milk is to keep it from noticeable decomposition due to micro-organisms for a longer time than is possible if no precautions are taken. It has been found by the experience of the Aylesbury Dairy Company that by cooling as soon as possible after milking, the milk can in the hottest weather experienced in England be brought up by rail from distances from 30 to 200 miles of London, and be delivered to customers in a condition permitting its use within a reasonable time. By refrigeration to low temperatures, such as is the rule in Denmark, and by pasteurization, milk could easily be transported even longer distances without preservatives.

"To attain the object of keeping milk for a time longer than natural, the preservative would be advantageously added at the farm; further doses may also be added both by the wholesale dealer and by the retailer.

"The object of preserving cream is chiefly to ensure that there shall be no loss of this comparatively valuable product through decomposition; this is especially the acse when it is sold in pots. The quantity used is greater than is added to milk, because it is required to keep for longer periods, frequently when in pots for over a week. The Aylesbury Dairy Company have found no difficulty in preparing and delivering cream in a fresh condition without the use of preservatives.

"The object of preserving butter is to prevent it becoming rancid and stale. (Rancidity is here taken to mean partial hydrolysis and liberation of lower fatty acids and staleness, partial oxidation and destruction of the flavour.) There is little evidence that the use of preservatives, even in the large amounts generally employed, have much effect, though decomposition is certainly delayed for a short period. Salt is nearly as efficacious in keeping butter from rancidity as boric preservatives, though its antiseptic power is much weaker. To further illustrate this, French butter is almost universally treated with boric preservative (see Table B), while Danish butter is universally free from this, but is salted. Trade experience has shown that no more complaints are received of Danish butter than of French butter—if anything, rather the opposite.

"There appears to be little necessity to add any preservative, unless salt can be thus classed, to well-made butter, if sold freshly made.

"B. *Colouring Matters.*—The whole of the substances enumerated as dairy products except condensed milk, which is very rarely coloured, and skimmed or separated milk, cream and junket, which would chiefly be coloured by being prepared from coloured milk, receive an addition of colouring matters.

"The colouring matters used are Annatto and organic dye stuffs chiefly of the tropæolin class. The quantity used varies much according to the natural colour of the milk, etc., but may be taken roughly as 1 part per 300,000 in milk and 1 part in 100,000 in butter and cheese. The quantities are calculated for the colouring matter itself, but the quantities of the commercial colouring substances may be taken roughly at 10 times that of the pure substances.

"The original object of colouring was to preserve continuity of colour during those months of the year in which milk and its products were nearly white, but owing to a mistaken idea among the public generally that colour indicates richness, dairy products are often artificially coloured more highly than they would ever be naturally for the purpose of making them look rich.

"In his opinion, it would be an advantage if colouring matter were altogether prohibited; the whole trade would then be on the same footing, and no fictitiously enriched milk would then be foisted on the public."

TABLE B. (Mr. D. Richmond.)

Quantity of Boric Acid in French Butters.

——	Total B_2O_3.	Calculated as Commercial Preservative.
Mean	0·336	0·599
Maximum	0·398	0·70
Minimum	0·305	0·54
Quantity of Boric Acid in Butter washed with solution of Boric Preservative.		
Mean	0·076	0·136
Maximum	0·094	0·17
Minimum	0·042	0·076

III.—VEGETABLES AND FRUITS.

Fresh vegetables, pickled vegetables, vegetables in bottles and tins, fresh fruits, desiccated fruits, crystallised fruits, tinned and bottled fruits, james, syrups, jellies, and confectionery.

The preservatives used for vegetables are, as far as my observation goes, usually salt and sometimes saltpetre for pickles, with vinegar; but if the vinegar contains a sulphite preservative traces of sulphite may also be present. Turmeric is used to colour piccalilli. Vegetables in bottles and tins do not appear to be treated with preservative, but beans and peas are coloured with sulphate of copper. Dr. B. Dyer has found quantities ranging from 0·8 grains to nearly 7 grains per pound of crystallised sulphate of copper. Mr. R. Bodmer has noted that tinned beans and peas contained sulphate of copper up to 3½ grains per pound; Mr. J. Pattinson sends figures giving the copper as varying from ·21 grains to 5·25 grains per pound; while Mr. Lowe finds from ·005 to ·01 per cent. of metallic copper is used, equal to ·35 grains to ·7 grains per pound.

"Among articles I recently examined I found that dried raisins were not treated with preservative, but two samples of desiccated apricots contained traces of sulphites. In tinned tomatoes, pears, apricots, and pineapple preserved in syrup no preservative substances were detected.

Jams frequently contain salicylic acid and artificial colouring matters. Dr. Dyer gives the proportion of salicylic acid as ½ grain to 1 grain per pound, and thinks it is probably used to preserve the fruit pulp. Mr. W. F. Lowe says that salicylic acid seems very generally used (in amounts between 0·01 to 0·06 per cent.), as it was found in more than 50 per cent. of the samples examined. The artificial colouring matters reported are "a colour resembling benzo-purpurine" by Mr. Stock, and rhodamine as being used to colour sweets and confectionery. Lead chromate has been used in confectionery; apparently it is no longer employed; but organic dyes, such as eosins, tropeolins, and others are used for sugar sweetmeats. Mr. Gatehouse mentions sugar dyed with yellow and brown aniline dyes, and once knew of a sugar dyed with a colour analogous to Bismarck brown, which produced violent sickness in a family.

Mr. H. Leffmann, Pa., informs us that for confectionery the following are largely used: Fluorescein, eosins, rhodamin, auramin, naphthol yellow S., Helvetia green, acridin red, Bismarck brown, and safranin. Among natural colours principally anatto, turmeric and chlorophyll.

For oils and fats, especially butter and butter substitutes some simple azo-colours of the type of Soudan I. are much used. Caramel is used for vinegar. Mineral colours made from zinc and copper are found extensively in canned vegetables, such as peas. For preservatives salicylic acid is largely used, but not so widely as formerly. It has been absolutely prohibited in the State of Pennsylvania, and this prohibition has been extended to all preservatives except sodium benzoate. This action has been taken, he says, partly at his suggestion, experiments having indicated that sodium benzoate is less objectionable than other preservatives. It is used in mincemeat, catsups, jams, and jellies.

IV. BEVERAGES AND SAUCES.

Draught ale and stout, bottled beer, lager beer, cider and perry, wines, British wines, medicated wines, non-alcoholic wines or beer, spirit liqueurs.

Aerated waters, lemonade, ginger beer, sweet aerated drinks, lime juice, etc.

Temperance drinks.

Sauces, vinegar, condiments.

The preservatives generally used for ales and beers are sulphurous acid or sulphites; the proportion of sulphurous acid is given by Mr. A. C. Chapman as 0·01 per cent., and Dr. Rideal found ·009 per cent. in bottled beer. Boric acid is occasionally met with, and salicylic acid ·03 g. per litre. The trade preparations intended for the preservation of articles of food and drink, which Mr. Chapman has met with were—Sulphurous acid and sulphites of (1) sodium, (2) potassium, (3) magnesium, (4) calcium, aluminium sulphate and sodium nitrate, chloral hydrate.

Salicylic acid and its sodium salt in several preparations, also benzoic acid in others. Dr. Stevenson has found salicylic acid in lager beer and non-alcoholic beer. Mr. Leffmann mentions fluorides. In respect of wines, salicylic acid is sometimes found in light sherries, orange quinine wine, ipecacuanha wine, also in unfermented wines. The proportion, according to Mr. Chapman, being ·015 g. per litre. Dr. B. Dyer found 0·3 grains per ounce in orange quinine wine deficient in spirit.

Mr. J. W. Gatehouse gives the proportions as 1 to 2 parts in 500 in non-alcoholic wines or beer. Recently I found salicylic acid in a raspberry syrup, the proportion being about ·05 per cent., and Dr. Rideal has found ·03 per cent. in peach bitters.

Spirits are not treated with preservatives, but caramel and other unknown colourings are reported as used for whisky.

Lemonade is not reported as containing preservatives, but sulphites, salicylic acid and colouring dyes are found in some aerated and sweet drinks. In some cases a red and in others a yellow is added; I once identified in "champagne perry," a sweet aerated drink, a scarlet azo-naphthol dye, the use of which, on my advice, was discontinued. Saccharin is mentioned as sometimes used in the place of sugar as sweetening for lemonade, sweet drinks, and temperance drinks, but this is hardly a preservative in the ordinary sense. Benzoic acid, on Dr. Rideal's authority, has been used in lemonade; formaldehyde in ginger beer, and salicylic acid in kola.

Vinegar may be preserved by sulphuric acid, or by sulphites; formalin may occasionally be used; and caramel is employed to colour by some makers. Recently five vinegars examined by myself officially were found to contain sulphites in small quantity—four were malt vinegars, and one of French manufacture. The proportion of sulphur dioxide in these samples was from ·004 per cent. to ·006 per cent. Dr. Hill reports ·02 per cent. boric acid in vinegar.

By the courtesy of a firm making vinegar, and other preparations, I have been placed in possession of the following information on the subject of preservatives and colouring matters used in articles manufactured by them.

Vinegar.—Colouring matter, caramel; formalin is occasionally used in the proportion of 0·03 per cent. when there are complaints of cask vinegar not keeping; but owing to its producing a certain degree of flatness it is not now used in the bulk of the vinegar.

British Wines.—As these have to be sweetened to meet the public taste, the small amount of alcohol then contain is an insufficiently preservative; calcium bisulphite is usually added i nthe proportion of from 0·5 to 1 per cent. and the wine kept until all odour of sulphur dioxide has disappeared.

Lime Juice and Lemon Cordial.—These are extraordinarily fermentable substances. The process in use consist in sterilizing, replacing part of the sugar by non-fermentable dextrin and saccharin and adding salicylic acid in the proportion of 6 to 7 ounces to 56 gallons of liquid [1 in 1,280 or ·08 per cent.]. But even this treatment is only partially effectual, and every season there are numerous complaints of fermentation. It may be mentioned that considerably more than this amount of salicylic acid has been found in the same preparations made by other firms.

Non-Alcoholic Wines.—Ginger, orange, black currant, etc. From 6 to 7 ounces of salicylic acid per hogshead is the smallest amount which will check fermentation over a long period. As soon as that amount is reduced complaints become numerous. In such cases as these sterilization cannot be used, since the wines are sent out in casks, and are expected to keep indefinitely.

Lemonade and Aerated Drinks.—Part of the sugar is replaced by saccharin. If thorough cleanliness be observed in the factory, no preservative is necessary, except occasionally in abnormally hot weather.

Brewed Ginger Beer.—This will keep perfectly for 2 to 3 months without preservative if properly made.

Sauces and Condiments.—Mustard is coloured with turmeric, and cayenne pepper is sometimes coloured. In samples of sauces examined, including many well-known kinds, no preservatives were found.

APPENDIX No. XIII.

Appendix.

Handed in by Dr. *A. Hill*, November 24th, 1899.

CITY OF BIRMINGHAM.

TABLE A.—MILK.

Variation in the use of Preservatives.

Year.	Percentage of Samples containing			
	Boric Acid.	Formic Aldehyde.	Both.	Total.
1896 (April—Dec.)	8·3	—	—	—
1897	5·5	3·3	0	8·8
1898	3·1	6·7	0·4	10·2
1899 (Jan.—Sept.)	1·2	6·3	0	7·5

TABLE B.—MILK.

Quantity of Boric Acid used.

April 1896—September 1899.

Boric Acid present.		Number of Samples.	
Percentage.	Grains per gallon.		
Less than 0·01	Less than 7	8	35
0·01–	7–	13	
0·02–	14–	14	
0·03–	21–	5	19
0·04–	28–	5	
0·05–	35–	9	
0·06–	42–	4	18
0·07–	49–	5	
0·08–	56–	4	
0·09–	63–	1	
0·10	70	3	
0·18	126	1	
	Total		72
Under 0·03	Under 21	35=49%	
0·03–0·06	21– 42	19=26%	
0·06–0·18	42–126	18=25%	

TABLE C.—MILK.

Effect of Formic Aldehyde on Souring.
Experimental Results.

Formic Aldehyde per 100,000 Milk. (Added, Thursday, 21 September 1899).	Acidity, as $\frac{N}{10}$ Alkali per 10 c.c., Milk.		
	Thursday.	Saturday.	Monday.
0	1·7	7·2	10·2
0·05	1·7	6·6	10·3
0·5	1·7	5·8	9·4
5	1·7	2·0	8·5
50	1·7	1·8	1·8

TABLE D.—MILK.

Effect of Season.

April 1896—September 1899.

MONTHS.	Percentage of Samples containing Boric Acid or Formic Aldehyde.
January	2
February	2
March	4
April	3
May	8
June	23
July	12
August	No samples.
September	17
October	12
November	6
December	4
HALF-YEARS.	
October—March	5
April—September	12

Appendix.

TABLE E.—MILK.

Relation between Preservatives and Adulteration.

——	Preservatives Present.	Preservatives Absent.
April 1896—September 1899.		
Percentage of samples :—		
Adulterated by skimming	10	7
Adulterated with water	10	6
Average Composition, 1898.		
Fat	3·6 per cent.	4·0 per cent.
Solids not fat	8·1 per cent.	8·5 per cent.
Total solids	11·7 per cent.	12·5 per cent.

TABLE F.—BUTTER (Samples free from Foreign Fat).

Variation in use of Boric Acid.

——	Number of Samples examined.	Percentage containing Boric Acid.
1896 :		
July—December	127	32
1897 :		
January—June	103	29
July—December	151	41
1898 :		
January—June	142	28
July—December	160	16
1899 :		
January—September	188	25

TABLE G.—BUTTER. (Samples free from Foreign fat.)

Effect of season.

July 1896—September 1899.

MONTHS.	Percentage of Samples containing Boric Acid.
January, February	32
March, April	32
May, June	15
July, August	26
September, October	27
November, December	30
HALF-YEARS.	
October—March	31
April—September	23

TABLE H.—BUTTER AND MARGARINE.

Percentage of Boric Acid used.

October, 1898—September, 1899.

Boric Acid Present.		Number of Samples.	
Percentage.	Grains per Pound.		
Less than 0·1	Less than 7	13	33
0·1–	7–	20	
0·2–	14–	18	32
0·3–	21–	14	
0·4–	28–	4	22
0·5–	35–	4	
0·6–	42–	5	
0·7–	49–	2	
0·8–	56–	1	
0·9–	63–	1	
1·0–	70–	1	
1·1–	77–	1	
1·2–	84–	1	
1·3	91	1	
1·6	112	1	
	Total	87	
Under 0·2	Under 14	33, or 38 %.	
0·2–0·4	14–28	32, or 37 %.	
0·4–1·6	28–112	22, or 25 %.	

TABLE I.—MEAT FOODS.

———	Number examined.	Number containing Boric Acid.
Bacon	7	5
Sausage	6	2
Pork Pie	4	1
Ham and Tongue	3	3
German Sausage	3	2
Polony	3	2
Chicken, Ham, and Tongue	2	2
Ham	2	2
Pickled Beef	2	1
Pickled Tongue	1	1
TOTAL	33	21

TABLE J.—MISCELLANEOUS ARTICLES.

Quantity of Boric Acid Used.

ARTICLES.	Boric Acid Found.	
	Percentage.	*Grains per Pound.*
Polony	0·65	45
Chicken, Ham, and Tongue	0·60	42
Pickled Beef	0·45	31
American Smoked Roll Bacon	0·40	28
Pickled Ham	0·15	10
Thick Cream	0·60	42
Clotted Cream	0·35	24
		Grains per Gallon.
Separated Milk	0·04	28
Malt Vinegar	0·02	14

TABLE K.—MISCELLANEOUS ARTICLES.

Proportion containing Boric and Salicylic Acid, respectively.

——	Number of Samples examined.	Number containing Boric Acid.	Number containing Salicylic Acid.
Thick cream - -	5	*4	*1
Clotted cream -	3	3	0
Skimmed milk -	11	1	0
Malt vinegar - -	12	1	0
Jam - - -	6	0	5
Sherry - . -	12	0	1
Ipecacuanha wine -	11	0	5
Total - - -	60	*9	*12

* One sample contained both boric and salicylic acid.

TABLE L.—SUMMARY.

April 1896—September 1899.

Articles.	Number Examined.	Number containing Preservatives.	Percentage containing Preservatives.
Milk - - -	1,537	135	9
Butter - - -	871	243	28
Margarine - -	120	101	84
Meat Foods - -	33	21	64
Other Articles -	60	20	33
Total - -	2,621	520	20

TABLE M.—PROSECUTIONS.

Year.	Article.	Boric Acid present.	Remarks.
1896	Milk -	56 grains per gallon (0·08 %)	Fined 1*s*., and 8*s*. costs.
,,	Milk -	63 grains per gallon (0·09 %)	Fined 10*s*., and 8*s*. costs.
1897	Milk -	77 grains per gallon (0·11 %)	Fined 5*s*., and 9*s*. costs.
1898	-	126 grains per gallon (0·18 %)	Fined 2*s*. 6*d*., and 14*s*. costs. Solid preservative used by farmer.
,,	Butter -	70 grains per pound (1·0 %)	Fined 1*l*., and 5*l*. 16*s*. 6*d*. costs. 5*l*. of the costs was for expert evidence.
,,	Butter -	77 grains per pound (1·1 %)	Fined 2*l*., and 9*s*. costs.
1899	Butter -	70 grains per pound (1·0 %)	Fined 2*l*., and 10*s*. costs.
,,	Butter -	84 grains per pound (1·2 %)	Fined 1*l*., and 8*s*. costs.
,,	Butter -	63 grains per pound (0·9 %)	Fined 2*l*., and 8*s*. costs.
,,	Butter -	91 grains per pound (1·3 %)	Fined 1*l*. and 9*s*. costs.
,,	Butter -	112 grains per pound (1·6 %)	Prosecution dismissed, the vendor having proved a warranty.

Dr. Hill has, since he gave evidence, supplied some additional tabular data to September 1900, which are incorporated in the Summary in paragraph 49 of the Report. The data are as follow :—

SUPPLEMENT TO TABLE A.—MILK.

October 1899—September 1900.

Percentage of samples containing—

Boric Acid - - - - -	2·6
Formic Aldehyde - - -	10·9
Both Preservatives - - -	0·9
Total - - -	14·4

SUPPLEMENT TO TABLE B.—MILK.

October 1899—September 1900.

Boric Acid Present.		Number of Samples.
Percentage.	Grains per gallon.	
0·01	7	1
0·015	10	1
0·02	14	1
0·025	17	2
0·03	21	2
0·045	31	2
0·09	63	2
0·13	91	1
	Total - - -	12

TABLE D.—MILK.

(Enlarged to include October 1899—September 1900.)

April 1896—September 1900. (1,877 Samples).

MONTHS.	Percentage of Samples containing Boric Acid or Formic Aldehyde.	
November - - -	8	4
December - - -	3	
January - - -	1	
February - - -	2	
March - - - -	3	
April - - - -	3	
May - - - -	10	16
June - - - -	24	
July - - - -	12	
*August - - -	42	
September - - -	19	
October - - -	13	
Whole period - -	10	

* 33 samples of milk in 1900 only.

Appendix.

TABLE H.—BUTTER AND MARGARINE.

(Modified and enlarged to include October 1899—September 1900.)

October 1898—September 1900.

Boric Acid Present.		Number of Samples.		
Percentage.	Grains per Pound.	Foreign Fat present.	Foreign Fat absent.	TOTAL.
Less than 0·1	Less than 7	3	19	22
0·1—	7—	11	36	47
0·2—	14—	9	36	45
0·3—	21—	4	28	32
0·4—	28—	1	18	19
0·5—	35—	1	13	14
0·6—	42—	0	14	14
0·7—	49—	0	5	5
0·8—	56—	1	1	2
0·9—	63—	0	3	3
1·0—	70—	0	1	1
1·1—	77—	1	0	1
1·2—	84—	0	1	1
1·3	91	0	1	1
1·6	112	0	1	1
Totals - - -		31	177	208
Less than 0·2	Less than 14	- - -		69 or 33 per cent.
0·2—0·4	14—28	- - -		77 or 37 „
0·4—1·6	28—112	- - -		62 or 30 „

SUPPLEMENT TO TABLE F.—BUTTER.

(Samples free from foreign fat.)

October 1899—September 1900.

Number of samples examined - - - -	288
Percentage containing boric acid - - -	35

SUPPLEMENT TO TABLE L.

October 1899—September 1900.

Articles.	Number Examined.	Number containing Preservatives.	Percentage containing Preservatives.
Milk - - - - - -	340	49	14
Butter - - - - -	288	102	35
Margarine - - - -	23	19	83
Total - - -	651	170	26

APPENDIX No. XIV.

Handed in by Dr. *W. Williams*, November 23rd, 1899.

RETURN of the Legal Proceedings taken against Vendors of Articles of Food containing Preservatives, in the County of Glamorgan, from the 11th March 1897 to date.

M I L K.

Date of Proceedings.	Section of Act.	Name of Article.	Result.	Percentage of Preservative.	Wholesale or Retail.	Remarks.
2 July 1897 -	3	Milk -	Fined 40*s.* and costs, 6*l.* 14*s.*	0·3 % boric acid -	Retail.	
2 July „ -	3	ditto -	Fined 40*s.* and costs, 1*l.* 8*s.*	0·2 % ditto - -	ditto.	
28 Nov. 1898 -	6	ditto -	Fined 2*l.* - - - -	0·13 % ditto - -	ditto.	
7 Dec. „ -	6	ditto -	To pay costs, 1*l.* 11*s.* 6*d.* -	0·019 % ditto - -	ditto.	
31 Aug. 1899 -	6	ditto -	Withdrawn - - -	0·037 % ditto - -	ditto.	

B U T T E R.

Date of Proceedings.	Section of Act.	Name of Article.	Result.	Percentage of Preservative.	Wholesale or Retail.	Remarks.
11 Mar. 1897 -	6	Butter -	Fined 25*s.* 6*d.*, including costs.	1·6 % boric acid - -	Retail.	
11 Oct. „ -	6	ditto -	Fined 20*s.* and costs, 1*l.* 5*s.*	0·9 % ditto - -	ditto.	
11 Oct. „ -	6	ditto -	Dismissed - - - -	0·5 % ditto - -	ditto -	Exception taken to form of analyst's certificate.
20 Dec. „ -	6	ditto -	Withdrawn - - -	0·5 % ditto - -	ditto -	- - ditto - - - ditto.
19 Jan. 1898 -	6	ditto -	Fined 5*l.* and costs - -	0·9 % ditto - -	ditto.	
29 Jan. „ -	6	ditto -	Fined 30*s.* - - - -	0·9 % ditto - -	ditto.	
2 Feb. „ -	6	ditto -	Fined 1*l.* and costs - -	0·6 % ditto - -	ditto.	
16 Feb. „ -	6	ditto -	Fined 2*l.* and costs - -	0·8 % ditto - -	ditto.	
Mar. „ -	6	ditto -	Withdrawn - - -	0·8 % ditto - -	ditto -	Adjourned; subsequently withdrawn. Exception taken to form of certificate.
4 Mar. „ -	6	ditto -	- ditto - - - -	0·7 % ditto - -	ditto.	
29 Mar. „ -	6	ditto -	Dismissed - - - -	0·6 % ditto - -	ditto -	Exception to form of certificate.
1 Oct. „ -	6	ditto -	- ditto - - - -	0·6 % ditto - -	ditto -	- - ditto - - ditto.
14 Nov. „ -	6	ditto -	- ditto - - - -	0·7 % ditto - -	ditto -	Technical error of one day in summons.
29 Jan. 1899 -	27	ditto -	- ditto - - - -	0·6 % ditto - -	Wholesale	False warranty. No proof before Court that warranty given by defendant as forming original contract.

H A M.

Date of Proceedings.	Section of Act.	Name of Article.	Result.	Percentage of Preservative.	Wholesale or Retail.	Remarks.
1 June 1898 -	6	Ham -	Dismissed - - - -	0·6 % boric acid - -	Retail -	Although summons was taken under Sec. 6, the magistrates were of opinion that the quantity used was not injurious to health.

APPENDIX No. XV.

Handed in by Dr. *H. Handford*, November 23rd, 1899.

A.

REPORT of ANALYSIS of MILK received 14 November from Dr. *Buckley*, General Hospital, Nottingham.

17 November, 1898.

I am of opinion that this Sample contains Boric Acid to the extent of 28·96 grains per gallon. Other preservatives are absent.

(Signed) SAMUEL R. TROTMAN, M.A.
City Analyst.

B.

RECOMMENDATIONS of the MEDICAL COMMITTEE, General Hospital, Nottingham, with reference to the supply of Milk to the Hospital.

The milk should be supplied under a strict guarantee :

1st. That it shall be derived from Cows which are healthy [and which have been proved to be free from Tubercle by the Tuberculine Test].

2nd. That it shall contain a minimum of 3 per cent. of fat.

3rd. That it shall not contain, when delivered to the Hospital, Boric Acid, Salicylic Acid, Formalin, or any preservative or added or foreign substance whatever.

4th. That it shall be delivered fresh and in good condition to the satisfaction of the Matron.

5th. That the Cowsheds and Dairy whence the milk is derived shall have been inspected and approved by the Medical Officer of Health of the district where they are situated, under the Dairies, Cowsheds, and Milkshops Orders, 1885–6.

[The Medical Committee further recommend that a complete analysis be made of the milk by the City Analyst at least once a month.]

The whole of the above Recommendations, with the exception of the two paragraphs in brackets, were included in a Form of Tender which the Contractor has agreed to and signed.

C.

7 October, 1899.

ANALYSIS of MILK received from the NOTTINGHAM GENERAL HOSPITAL, 6 October, 1899.

This sample is of good quality.

It contains per 100 parts—

Fat - - - -	3·40
Solids not Fat - -	9·08
Water - - - -	87·52

Preservatives are absent.

(Signed SAMUEL R. TROTMAN, M.A
City Analyst.

D.

The Rural District Council of Basford.

115, Waterloo Crescent,
Nottingham, 25 May, 1899.

I visited Mr. ——'s Cowsheds at —— on 5th January, 1899, and then made suggestions as to improving the ventilation. I visited them again to-day, and found my suggestions were carried out, and I now certify that the Cowsheds are in a good sanitary condition as regards ventilation, drainage and cleanliness; that the water-supply, on the constant system, is of good quality; and that the cleansing of the utensils is carefully carried out.

(Signed) G. B. WRAY,
Medical Officer of Health.

APPENDIX No. XVI.

PERSONAL VIEWS ON THE USE OF PRESERVATIVES AND COLOURING MATTERS IN FOODS.

Handed in by Mr. *W. F. Lowe*, Public Analyst for the Counties of Flint, Carnarvon, Anglesey, and Denbigh, and for the City of Chester.

I consider that this use of preservatives in all but a very few cases should be entirely prohibited, for the necessity for them is entirely obviated by the use of cold storage, for by it practically all food, even fruit, can be preserved without deterioration by properly regulating the temperature of the refrigerator.

In most cases preservatives can hardly fail to be more or less injurious to health, and especially to the health of weak persons and young children. As an instance of this I had, during the hot weather of last summer, a sample of milk brought me for examination for preservatives, as it was believed to have made a baby two months old very seriously ill with troublesome vomiting, or, as the parents said, to have poisoned the child. This milk contained an exceedingly small amount of formalin, and probably would not have been at all injurious to strong persons; in fact, I believe no one else in the house suffered from it.

The doctor who attended the case attributed the illness to the formalin acting as an irritant.

The habitual use of the powerful drugs used as preservatives is also very liable to injure the digestive organs of strong people by arresting or retarding the action of the natural ferments of the human body.

The proportion of various drugs capable of arresting the action of enzymes is given in the following table from Lauder Brunton's "Pharmacology and Therapeutics," page 78:—

——	Diastase.	Ptyalin.	Pepsin.	Pancreatin.
Copper Sulphate - - -	1 : 6500	1 : 7500	1 : 110	1 : 6600
Salicylic Acid - - -	1 : 5100	1 : 1250	1 : 250	1 : 9000
Benzoic Acid - - -	1 : 1025	1 : 2600	1 : 200	1 : 2600
Sulphurous Acid - - -	1 : 8600	1 : 8600	—	—
*Borax - - - - -	1 : 100	1 : 100	—	—

* Contains 37 per cent. of boric acid.

The table gives the amount of the drug capable of arresting the action of the ferment, but no doubt injury may be done to the human body by lessening the action of natural ferments without actually arresting their action.

Besides its action on enzymes each of the drugs used as a preservative has its own special therapeutic effect.

Boric acid, for instance, in large doses is said to produce sickness and diarrhœa, and in small doses to produce certain skin diseases. That it is a much more powerful drug than it was originally thought to be is proved by the dose in the new edition of the British Pharmacopœia, 1898, having been reduced to one-half (from 30 grains to 15 grains).

Salicylic acid is said to produce chronic dyspepsia if taken regularly, even in very small quantities.

Another very strong objection to the use of preservatives is that they may be added to food that is already beginning to undergo decomposition, and which is therefore unfit for consumption, but by the use of a powerful preservative, which arrests further decomposition, it can be made to appear good and sound.

Salicylic acid, for instance, is largely used in the manufacture of jam, and there is no doubt chiefly on account of its property of arresting the fermentation of unsound fruit.

As to the quantities usually added to food, I have found boric acid only in milk, cream, and butter. In butter to the extent of 8 up to 50 gr. per lb., and milk and cream from 6 to 20 gr. per pint.

It is also very largely used for preserving bacon, and a large provision dealer assured me that American bacon is very rarely free from it.*

Salicylic acid I have found in jam and also in British wine. In jam it has been present to the extent of 2 to 4 grs. per lb., but if it was added to the fruit before boiling a good quantity would probably be lost.

Formalin I have found only in milk and cream, but as there is no reliable method for estimating it in food I have not attempted to do so.

As to colouring matter in food, the most important, I think, is the use of copper for giving a green colour to tinned peas and beans. Most of these come from abroad, chiefly from France and Italy, but they are now being coloured by several English firms. The quantity of copper present is usually from 0·007 per cent. to 0·01 per cent., or about ½ to ¾ gr. of metallic copper per lb. (but I have on one or two occasions found a larger amount). The usual amount of copper is equal to about 2 to 3 gr. of sulphate of copper per lb. There appears to be a very strong attempt being made to legalise the sale of these articles, for most of the cases taken into court in my district have been defended by the wholesale dealers, often at a considerable expense, but I have obtained convictions in almost all the cases I have had.

Almost all the highest medical opinion in the country appears to consider the use of copper injurious to health; the opinion in Taylor's "Medical Jurisprudence" (p. 315) is as follows: "The quantity of copper contained in such articles may not be sufficient to cause fatal effects, but serious symptoms of gastric irritation are sometimes produced, and in young persons these may assume an alarming character."

Dr. Luff also condemns it: "The employment of copper as an artificial colouring for articles of diet must be regarded as the admixture of a noxious substance, and therefore as rendering the article injurious to health" (Luff's "Forensic Medicine and Toxicology," p. 206), whilst Dr. Lauder Brunton also appears to consider that chronic copper poisoning may be produced: "Chronic copper poisoning is said to have occurred in consequence of the use of copper salts to give a bright green colour to tinned peas and other vegetables, as well as from the employment of imperfectly cleaned copper pans. Some doubt has been thrown on the possibility of producing chronic poisoning by the internal administration of copper in small doses, as in some experiments it was given to animals for a length of time without injury. More recent experiments, however, show that at least in ruminants chronic poisoning may be produced" (Lauder Brunton's "Pharmacology and Therapeutics," p. 666).

These articles are especially injurious to weak persons and children. The reply of the Medical Officer of Health in one of my districts to a question in a case of coppered peas before the magistrate has, I think, a very strong bearing on this point. He was asked by the chairman (a big, strong man) whether these peas would do him (the chairman) any harm, and his reply was "No, very probably they would not do you any harm"; but, turning to another of the magistrates, who was a much older man (who had recently recovered from a severe illness), "but they might kill Mr. B——."

As to the use of other colouring matter, with the exception perhaps of Prussian blue for colouring sweets, I have not found any that I should consider injurious to health. Margarine, of course, is always coloured, and butter occasionally, but I have only found annatto in the samples I have examined, and I do not think that injurious colours are used for this purpose. As to the colouring of margarine, I believe if it was made illegal the sale of this cheap and useful food would be destroyed, for in my opinion margarine is much more wholesome than a large quantity of the old and rancid butter that is used for food; I have frequently had samples of slightly rancid butter brought to me for analysis, as the purchaser thought from the taste and smell that it must be margarine.

Mustard is frequently coloured with turmeric, but except that it is perhaps used to disguise the admixture of a large amount of flour, I do not think there is much objection to it.

The dyeing of sugar is of course a fraud, and is decidedly an adulteration, but I have not had many samples of sugar to examine, and only one that was dyed.

The use of Prussian blue for colouring sweets is, I think, very objectionable, if not dangerous, for it seems probable that the insoluble and non-poisonous cyanides of the colouring matter might possibly, under certain conditions of the digestive organs, be converted into some of the poisonous cyanides. I have not been able to find any information on this point, except that Prussian blue is generally considered non-poisonous. I have frequently found the blue sweets coloured with Prussian blue.

Spirits, especially whisky, are very frequently coloured with caramel.

W. F. Lowe, Assoc.R.S.M., F.I.C.

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* Boric Acid is also used by butchers, for I received from the Chief Constable of Anglesey a packet of a preservative he found being largely used by a butcher for sprinkling his meat in the hot weather. The packet consisted of boric acid and was labelled "The Universal Food Preserver. To preserve fresh meat, sausages, fish, milk, butter, and various articles of food, sound and sweet in the hottest weather. Prepared by Robert Seager, Ham and Bacon Curer, and Sausage Manufacturer, Ipswich."

APPENDIX No. XVII.

Letter addressed to Professor Thorpe by the Government Analyst of British Guiana, relative to the Tinting of West Indian Sugar.

Dear Dr. Thorpe,

A very representative meeting of proprietors of sugar factories in the West Indies and British Guiana was held yesterday (7th inst.), and it was resolved that steps should be taken to put an end to the use of chloride of tin in the manufacture of so-called Demerara crystals, and orders will be sent out privately and individually to the agents and managers to this effect. As you are aware no cases of injury to human beings have been reported as having arisen from the presence of minute traces of tin in these sugars, but the universal opinion was that in the light of increased knowledge of the cumulative action of minute traces of metallic salts makers of crystallised raw Demerara sugars would not be justified in continuing the use of such salts.

I remain, dear Dr. Thorpe,
Yours faithfully,
J. B. Harrison.

20, Talbot Road, Bayswater,
8th February, 1901.

APPENDIX No. XVIII.

Appendix.

Handed in by Mr. *Leonard K. Boseley*, as promised on November 17th, 1899.

LIST of COLOURING MATTERS used in CONFECTIONERY.

No.	Trade Names.	Colours.	Scientific Names.
1	French Cream Pink, Rhodamine	Reds.	Hydrochlorate of the phthalein of di-ethyl-meta-amido-phenol.
2	Concentrated Pink		A mixture of hydrochlorate of rosaniline with milk sugar, or starch.
3	Magenta		Fuchsine, hydrochlorate or acetate of rosaniline.
4	Rhodites		Hydrochlorate of the phthalein of di-ethyl-meta-amido-phenol.
5	Cherry Red		Sodium salt of tetra-iod-fluorescine.
6	Ponceau Red		Biebrich or crocein scarlet. Sodium-benzene-naphthol sulphonic acid.
7	Vermilion		A pure aniline colour.
8	Rose Red		Purified aniline colour. Guaranteed harmless.
9	Saffron Yellow	Yellows &c.	*Probably* the sodium salt of amido-azo-benzene sulphonic acid.
10	Primrose Yellow		Auramine. (This colour is sold in three grades, 1, 2, and 0).
11	Imperial Yellow		Ammonium or sodium salt of hexanitrodiphenylamine.
12	Citron Orange		The sodium salt of xylene-sulphonic-acid-azo-B-naphthol.
13	Chocolate Brown	Brown and Black.	An aniline colour. (No details as to composition.)
14	Jetoline Black		Probably di-amine black.
15	Heliotrope	Violets.	Hoffman's violet R, Hydrochlorate of tri-ethyl rosaniline.
16	Lavender		A mixture of Hoffman's violet.
17	Damson Blue		Also a mixture of Hoffman's violet.

The following colours are also used (Scientific names not given):—Rose paste, Brown paste, Tuscan Orange, and Salmon Pink. The first two are probably mixtures of some of the above-named colours with aluminium hydroxide.

APPENDIX No. XIX.

Handed in by Mr. *J. Wheeler Bennett*, November 14th, 1899.

(Letter from the High Commissioner for Canada.)

17, Victoria Street,
London, S.W.

7 October 1899.

Dear Mr. Wheeler Bennett,

As requested in your letter of the 5th inst., I have much pleasure in giving you below figures relating to the value of bacon and hams exported from Canada to Great Britain for the years 1889–98 —

BACON AND HAMS.	Dollars.
1889	380,227
1890	643,724
1891	690,210
1892	1,225,482
1893	1,960,646
1894	2,914,778
1895	3,798,341
1896	4,370,364
1897	5,831,623
1898	8,034,616

Appendix.

Many have been made on animals, others on men. Mr. Galippe, after experimenting on himself, has not hesitated in using for many months, for himself and for the whole of his family, vegetables cooked and preserved in copper basins.

It has been asked if vegetables greened with copper, though not toxique, were not likely to interfere with digestion. This is not likely, as copper salts—sulphate, acetate, are soluble in water, and the copper fixed on vegetables is found to be in an insoluble form, since the water which contains them hardly shows any trace of them.

Copper exists there in a state of combination, ill-defined and stable, which probably does not attack, or attacks with great difficulty the liquids in human economy.

Messrs. Petit and Sley have made experiments on this point, 2 grammes of sulphate of copper dissolved in 40 c.c. of distilled water have been added to 60 c.c. of gastric juice, in which have been placed 20 grammes of blood fibrine; the whole has been kept in a condenser at 45° for 18 hours. Result: the fibrine was entirely dissolved.

Mr. Ogier has prepared in his laboratory peas and beans in the natural state, also some greened with copper; the proportion of copper varied from 10,100 and 740 milligrammes per kilo. of vegetables. He has then submitted both, under similar conditions, to experiments on digestibility with pepsine maceration of calf's stomach, pomeractic juice. The digestibility of both has been identical.

Let us add that no trace of accident due to copper has ever been found in persons eating cacao or chocolate, a food which, according to Duclaux, contains notable proportions of copper, indeed sometimes superior to that introduced in greened vegetables.

Conclusions: Owing to our analysis of the 19 samples of greened peas as above, it is rational to conclude that the consumption of peas, greened with copper as per actual process, does not offer any danger to public health.

A. Riche,

Member of the Academy of Medicine; Professor of Mineral Chemistry at the Paris Superior School of Pharmacy; Director of the Ministry of Commerce Laboratory.

APPENDIX No. XXI.

Handed in by Mr. *John Walton Copeman*, November 20th, 1899.

1re Division.

PRÉFECTURE DE LA GIRONDE.

Hygiène et Salubrité.

Emploi des sels de cuivre pour le reverdissage des conserves alimentaires.

Nous Préfet de la Gironde, officier de la légion d'honneur;

Vu l'arrêté préfectoral en date du 17 Juillet 1882, interdisant l'emploi des vases et sels de cuivre dans la préparation des conserves de fruits et légumes destinées à l'alimentation;

Vu la circulaire de M. le Ministre de l'Interieur en date du 18 Avril 1889;

Considérant qu'il résulte des nouvelles expériences opérées par le Comité consultatif d'hygiène publique de France que le reverdissage des conserves alimentaires peut être affectué a l'aide des sels de cuivre sans danger pour la santé publique;

Arrêtons:

Article 1er.—L'arrêté du 17 Juillet 1882, portant interdiction aux fabricants et commerçants d'employer des vases et des sels de cuivre dans la préparation des conserves de fruits et légumes destinées á l'alimentation est et demeure rapporté.

Article 2e.—MM. les Sous-Préfets et Maires du département sont chargés d'assurer, chacun au ce qui le concerne, l'exécution du présent arrêté, qui sera inséré au Recueil des Actes administratifs et à la Feuille du dimanche.

Bordeaux, le 24 Avril 1889.
Pr le Préfet,
Le Secrétaire Général,
(Signé) Couzinet.

Pour ampliation,
Le Conseiller de Préfecture,
A. Lacarrière.

[I hereby certify that the signature "A. Lacarrière" at the foot of this page and at left hand side of same is the signature of Mr. Lacarrière, "Conseiller de Préfecture de la Gironde," and that the seal opposite the said signature is the official seal of the said Préfecture, as witness my hand and seal of office at Bordeaux, France, this 27th January, 1896.

William Ward,
Her Britannic Majesty's Consul.]

APPENDIX No. XXII.

Handed in by Mr. *John Walton Copeman*, November 20th, 1899.

A.—Deaths from Food Poisoning in England; extracted from the Annual Reports of the Registrar General.

——	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	Total.
Putrid meat	1	–	1	–	–	–	11	5	6	24
Poisonous fish	1	4	3	2	9	3	14	8	6	50
Tinned foods	2	–	–	–	–	–	–	–	–	2
Whelks	1	–	–	–	–	–	–	–	–	1
Decomposed fruits	–	5	–	–	–	–	–	–	3	8
Improper food	–	1	–	3	6	2	1	–	–	13
Mussels	–	–	1	–	–	–	–	–	–	1
Winkles	–	–	–	1	–	–	–	–	–	1
Unripe fruit	–	–	–	–	1	–	–	3	–	4
Ptomaines	–	–	–	–	1	–	7	12	9	29
Unsound food	–	–	–	–	–	–	–	–	2	2
Fermented condensed milk.	–	–	–	–	–	–	1	–	–	1
Tinned fruit	–	–	–	–	–	–	–	1	–	1
										137

B.—Deaths by poison (accidental) 1888 to 1897; among the deaths from metallic poisoning recorded by the Registrar General in the ten years, only one by sulphate of copper finds mention.

Appendix.

APPENDIX No. XXIII.

Handed in by Dr. *W. Williams*, November 23rd, 1899.

COUNTY OF GLAMORGAN.

MILK.

Specimens examined, with Results.

Year.	Estimated Population of Administrative County.	Number of Samples examined.	Number of Samples containing Boric Acid.	Per Cent. of Samples containing Boric Acid.	Quantities of Boric Acid present.		REMARKS.
					Per Cent. of Boric Acid.	Grains per Gallon.	
1897 - -	589,806	332	11	3·3	0·024	17	Of these, 5 contained small quantities only and amount not stated.
					0·030	21	
					0·033	23	
					0·08	56	
					0·2	140	
					0·3	210	
1898 - -	608,998	379	3	0·8	0·019	13½	
					0·024	18	
					0·13	91	
1899 - - (9 months.)	—	265	3	1·1	0·02	14	
					0·037	26	
						(Not sufficient quantity for analysis.)	

BUTTER.

						lb.	
1897 - -	589,806	82	37	45·1	0·015	1	
					0·03	2	
					0·05	3·99	
					0·07	5	
					0·10 (3)	7	
					0·12	9	
					0·13 (3)	9	
					0·17 (2)	12	
					0·18 (3)	12	
					0·22	16	
					0·25	17·92	
					0·30 (2)	21	
					0·40 (4)	28	
					0·49	34	
					0·50 (3)	35	
					0·60 (2)	42	
					0·7 (2)	49	
					0·8	56	
					0·9 (3)	63	
					1·6	112	
1898 - -	608,998	123	42	34·1	0·07	5	
					0·10	7	
					0·12 (2)	9	
					0·15 (2)	11	
					0·17	12	
					0·19	13	
					0·20	14	
					0·21 (2)	15	
					0·22	16	
					0·25 (2)	17·92	
					0·27	19	
					0·28	20	
					0·3 (3)	21	
					0·31	22	
					0·32	23	
					0·35 (2)	26	
					0·37	26	
					0·39	27	
					0·41	29	
					0·42 (2)	30	
					0·45	32	
					0·48 (5)	34	
					0·5	35	
					0·6 (3)	42	
					0·7 (3)	49	
					0·8	56	
1899 - - (9 months.)	—	83	22	26·5	0·02	2	
					0·08	5	
					0·09 (2)	6·5	
					0·13	9	
					0·14 (2)	10	
					0·18 (2)	12·5	
					0·25	17·92	
					0·28	20	
					0·30	21	
					0·32	23	
					0·35 (2)	26	
					0·38	26·5	
					0·41	29	
					0·43	31	
					0·48	34	
					0·50 (3)	35	

APPENDIX No. XXIV.

Handed in by Dr. *Samuel Rideal* on January 15th, 1900.

The Time Milk is kept sweet by the addition of 1 : 2,000 of Boric Acid, or 1 : 50,000 of Formaldehyde at Various Temperatures.

In order to ascertain this, quantities of fresh milk, containing (1) 1 : 2,000 of boric acid; (2) 1 : 50,000 of formaldehyde; (3) control, were measured into balloon flasks and loosely plugged with cotton wool. These sets were then incubated at the following temperatures, 13 C., 18 C., and 24 C. (as representing approximately winter, medium, and summer temperatures), and 25 c.c. taken out from each and titrated every few hours with decinormal soda, using phenol-phthalein as an indicator, the total acidity being calculated to lactic acid (1 c.c. N/10 soda = ·009 gramme of lactic acid). The original milk at starting required 5 c.c. N/10 soda per 25 c.c., corresponding to 0·18 per cent. of lactic acid.

PER CENT. LACTIC ACID.

——	13 C. (55·4 F.)	18 C. (64 F.)	24 C. (75·2 F.)
15 hours:			
Blank - - - - -	0·18	0·20	0·23
Boric acid - - - -	0·18	0·18	0·22
Formaldehyde - - -	0·18	0·18	0·19
20 hours:			
Blank - - - - -	0·18	0·20	0·24
Boric acid - - - -	0·18	0·20	0·22
Formaldehyde - - -	0·18	0·18	0·20
23 hours:			
Blank - - - - -	0·18	0·21	0·28
Boric acid - - - -	0·18	0·18	0·24
Formaldehyde - - -	0·18	0·18	0·22
39 hours:			
Blank - - - - -	0·19	0·39	0·80
Boric acid - - - -	0·18	0·26	0·65
Formaldehyde - - -	0·17	0·21	0·59

From these results it will be noticed that at the lowest temperature, viz., 13° C., even after 39 hours there is no increase in the acidity of the milks containing boric acid and formaldehyde, the actual titrations recording a slightly lower amount of lactic acid. In these two milks at 18 C. there is no appreciable rise in the acidity till after 23 hours incubation. In considering the results at 24 C. the question as to what maximum acidity can be allowed to milk without its being pronounced sour is raised.

Thorner (Chem. Zeit., 1891, p. 1108) has investigated the acidity requisite to coagulate milk. Titrating under similar conditions to the above, he found that milk coagulated on warming when the acidity reaches 22 (c.c. N/10 soda per 100 c.c. of milk), corresponding to 0·207 per cent. of lactic acid. I have found the coagulating point somewhat higher than this. Normal milk was incubated at 22 C., and every few hours a fraction was removed and tested by heating to 100 C. for five minutes and also by pouring some of the milk into boiling water, the acidity being determined at the same time.

Number of Hours.	Degree of Acidity.	Per Cent. of Lactic Acid.	Coagulation Tests.
1	18	0·162	Both tests negative.
4	19	0·171	- - ditto.
6	19·2	0·173	- - ditto.
8	19·6	0·176	- - ditto.
11	20·4	0·184	- - ditto.
15	28	0·252	Coagulated at 100 C., but not by pouring into hot water.

Therefore, when the acidity exceeds 0·25 per cent. lactic acid, the milk would be considered sour and unfit for sale. And taking this as the maximum acidity allowable, it will be seen from the previous table that in all cases the milk has been kept sweet by the 1 : 2,000 boric acid, and 1 : 50,000 of formaldehyde over the 23 hours.

In repeating this experiment, with a milk incubated at 18 C., it was found that when the acidity was equal to 25·6 degrees, or 0·230 per cent. of lactic acid, the milk was sufficiently acid to cause a slight coagulation on heating on the water-bath. It will therefore be seen that Thorner's limit of 0·207 per cent. of lactic acid is rather too low, and that from 0·23 to 0·25 per cent. of lactic acid is the limit which may be regarded as safe for dietetic purposes.

APPENDIX No. XXV.

Handed in by Major *Charles E. Cassal*, January 15th, 1900.

(1.)

EXTRACTS from the Annual Report of *Charles E. Cassal*, F.I.C., the Public Analyst for the Parish of Kensington, for the year ended 31st March, 1891.

15. The addition of boracic acid preparations to milk is a matter upon which special reports have been made at the request of your vestry. It has been stated that proceedings might be taken under the 3rd Section of the Sale of Food and Drugs Act, 1875. Proceedings might be taken under the 6th Section of that Act and the 2nd Section of the Amendment Act of 1879, inasmuch as milk containing boracic acid may be regarded as not of the "quality" of milk demanded by the purchaser, the proof of defect in the quality of an article being sufficient for action to be taken, whatever views may be held as to what constitutes legal defects in the "nature" and "substance" of such article. The 6th Section provides that an offence shall be deemed to be committed if an article is not of the nature, substance, and quality demanded by the purchaser; the 2nd Section of the Amendment Act provides that it is not incumbent on the prosecution to prove defects in all these three respects. Defect in any one is sufficient. No offence under this section, however, is committed "where any matter or ingredient not injurious to health has been added to the food or drug because the same is required for the production or preparation thereof as an article of commerce, in a state fit for carriage or consumption, and not fraudulently to increase the bulk, weight, or measure of the food or drug, or conceal the inferior quality thereof." It may, however, be contended that the admixture is not required for preservation in course of transit, as when this is necessary there are other, although more expensive, means (*i.e.*, refrigeration) of accomplishing the object; and it may further be held that it does enable the inferior quality of a milk to be concealed, as the practice allows of stale milk being sold as fresh or new milk.

16. Your vestry decided to ask for the opinions of Sir

Andrew Clark, M.D., Sir Henry Thompson and Dr. Lauder Brunton, with respect to the admixture of boracic acid and its compounds with articles of food. The replies of these gentlemen were entered upon the minutes of the vestry. Sir Andrew Clark, while regretting his inability to take part in any special enquiry, made the following remarks:—"Seeing that chemical compounds are now widely employed in the preparation and preservation of foods, knowing that many of them, although innocuous in small occasional doses, become in small doses continued over long periods destructive to health; and, furthermore, believing that many obscure and incurable disorders are begotten in this manner, I regard the enquiry proposed by your vestry as one of the greatest importance to the well-being of the community; and certain, if successfully completed, to prove of great public advantage."

Sir Henry Thompson remarked that, technically, the addition of preservatives must be regarded, more or less, as constituting an adulteration; that there was no doubt, on the authority of physicians in Germany and in this country, that boric acid in what was called "full doses" was an irritant to the digestive organs, but that it by no means followed that a small quantity should exercise any evil influence whatever. He was of opinion that a quantity of eight or ten grains to the pint of milk, the amount generally used, would not be injurious to the adult who consumed, say, a pint daily—an ample allowance; but that, on the other hand, the infant, who was a large consumer of milk, was also much more liable to injury by the admixture of boric acid, being far more susceptible than the adult to the influence of all chemical agents. The proportion named "would be calculated to be injurious when taken habitually, certainly to children under three or four years of age."

Taking all the facts cited into consideration, Sir Henry Thompson was "disposed to believe that the employment of a small proportion of boric acid might be permitted in the milk trade with advantage to the consumer, on the following conditions":—(1). "A declaration should be required respecting all milk and cream offered for sale, whether or no any boric acid or other agent has been added thereto for the purpose of preserving it." (2). "A precise statement should be made upon a label bearing also the name of the salesman, to be affixed to all vessels containing milk or cream offered for sale, naming the preservative agent employed, and the quantity added per pint." (3). "When milk or cream thus 'preserved' is sold 'on draught,' a ticket should be supplied to the purchaser, containing the information furnished by the label above named." (4.) "When specimens thus certified and sold are proved by analysis to contain a notably larger quantity than that named on the ticket or label, or when specimens declared to be free from admixture with any chemical agent are found to contain one, the salesman should be proceeded against for selling milk which is adulterated, knowing it to be so. Such regulations would ensure to each individual who might desire to exercise his own judgment on this matter the opportunity of doing so."

Sir Henry Thompson also pointed out that remarks made with regard to boracic acid might be held to apply to borax also.

Dr. Lauder Brunton considered the question to be a particularly difficult one, and was uncertain what to say regarding it. He stated that he had no personal experience in the matter of the use of boracic acid, and that such information as he would be able to afford the vestry would be necessarily derived from books. Upon this authority he stated that it was "known to be a poison in large doses" and had "also been found to be injurious when added to foods."

(2.)

BORIC ACID IN BUTTER.

EXTRACTS from the Annual Report of *Charles E. Cassal*, F.I.C., the Public Analyst for the Parish of Kensington, for the year ended 31st March, 1893.

Letter from the Vestry Clerk of Kensington to the Secretary of the Local Government Board.

Town Hall, Kensington,
16th May, 1893.

Sir,

I HAVE been directed by the Vestry of Kensington to bring under the notice of the Local Government Board the extract which appears in the enclosed report of the public analyst of this parish dealing with the question of whether samples of butter found to contain boric acid preservatives should or should not be reported as adulterated.

From such extract it will be seen by the Board that the percentage of adulteration in this parish is appreciably increased, owing to our public analyst holding the opinion that he has no option, in drawing up his statutory report, but to return samples of butter containing boric acid as adulterated, and this view my vestry have no desire to combat. They, however, learn that some of the public analysts report such samples as genuine, and this being so, the vestry feel that by reason of the difference of views which appears to prevail among the public analysts, this parish, and those parishes and districts whose public analysts act in accord with ours, are prejudicially affected as regards the comparisons which may be drawn from the abstracts of reports of public analysts which are published in the annual report of the Local Government Board.

The vestry accordingly deem it expedient to seek some direction at the hands of the Board upon the point, and to request that the Board will state whether samples of butter containing boric acid for preservative purposes should be returned in the statutory report of the public analyst as adulterated or genuine, so that uniformity of procedure may prevail throughout the parishes and districts in which the Sale of Food and Drugs Acts are enforced.

I have the honour to be, sir,
Your obedient servant,
(Signed) *Wm. Chambers Leete*,
Vestry Clerk.

The Secretary, Local Government Board,
Whitehall, S.W.

To this letter the following reply was received:—

[Copy of Reply].

Local Government Board, Whitehall, S.W.
25th May, 1893.

Sir,

I am directed by the Local Government Board to acknowledge the receipt of your letter of the 16th instant, enquiring on behalf of the vestry of the Parish of St. Mary Abbotts, Kensington, whether butter found to contain boric acid for preservative purposes should or should not be reported as adulterated.

I am to state that the question is one which the Board have no authority to decide, but they may refer the vestry to note (*d*) appended to the form of certificate in the schedule to the Sale of Food and Drugs Act, 1875, which authorises the analyst to insert at his discretion his opinion whether any mixture was for the purpose of preserving the article, and whether it was excessive. I am also to refer to the remarks on the subject at page 6 of the enclosed extract from the board's report for 1890-91.

I am, sir,
Your obedient servant,
(Signed) *Alfred D. Adrian*,
Assistant Secretary.

To W. C. Leete, Esq., Clerk to the Vestry of the
Parish of St. Mary Abbotts, Kensington.

20. The following are the remarks in the extract from the Board's report alluded to in the above letter, the italics being mine to show the more important points:—

> "It may be noted that the use of boric and boracic acids as preservatives of butter and other substances liable to decompose speedily seems to be finding increased favour among dealers, and is at the same time creating a difficulty for analysts, since it is not always clear in what cases the addition may come within the proviso of section 6 of the Sale of Food and Drugs Act, 1875, with regard to 'any matter or ingredient not injurious to health' which 'has been added to the food or drug because the same is required for the production or preparation thereof as an article of commerce, in a state fit for carriage or consumption.' *There is no doubt that boric or boracic acid, if taken in large quantities, would be injurious to health, but we have no sufficient information to show* whether such minute amounts as are generally added as preservatives could be regarded as having that effect, and more exact information is wanted before it can be decided *whether a process which primâ facie may be regarded as intended to prevent the loss of valuable food*, must be held to be prohibited by law."

21. The present attitude* of the Local Government Board on the subject, at any rate with respect to butter,

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* *i.e.*, in 1893.—C. E. C.

Appendix.

is made perfectly plain by the reply of the Board to the vestry's letter and by the extract quoted. While adhering, therefore, to my previously-expressed opinion that the *unacknowledged* presence of boric acid preparations in food constitutes adulteration, I shall feel justified, in future, in classifying samples of butter containing boric acid only as "genuine," and in merely reporting the presence of that substance when it is found to have been added.

(3.)

Extract from the Quarterly Report of the Public Analyst for St. George, Hanover Square, for the quarter ended on the 31st December, 1896.

Preserved Peas.

The six samples submitted were all found to contain copper and were reported as adulterated. The particulars relating to these samples are as understated:—

Sample.	On the Sample as submitted.			On desiccated Sample.	
	Copper per cent.	Copper grains per pound.	Sulphate of Copper Grains per pound.	Copper per cent.	Copper grains per pound.
A.	0·006	0·422	1·664	0·0714	4·996
B.	0·0038	0·267	1·054	0·0365	2·56
C.	0·0085	0·596	2·35	0·0997	6·98
D.	0·008	0·562	2·216	0·0836	5·85
E.	0·0067	0·469	1·84	0·0532	3·72
F.	0·0085	0·593	2·336	0·0564	3·95

The attention of authorities concerned with the administration of the Food and Drugs Acts has recently been again directed to the presence of copper in preserved vegetables by a successful prosecution at the instance of the Board of Works for the St. Saviour's District, Southwark. A report of this case was forwarded to the vestry, and was considered by the Sale of Food and Drugs Acts Committee. As stated in the report referred to, there is no doubt that "the practice of colouring bottled peas by the addition of a salt of copper—usually the sulphate—is attended with injurious effects"; that "in most countries the practice is forbidden," and that "the recognised English text-books on poisons, medical jurisprudence, and foods are practically unanimous in their censure of the practice of adding the salt of copper for the purpose of imparting a fresh or bright green colour to the peas." It appears that as long ago as 1877 a vendor was convicted at the Marlborough Street Police Court for selling peas containing copper, and that other convictions have been secured since at Liverpool, Bradford, and Edmonton. In the case here referred to the magistrate convicted the vendor. The latter appealed, and after a protracted hearing at the Sessions before Mr. Soames, the Deputy-Chairman, when a number of witnesses were examined on both sides, the appeal was dismissed, and the conviction was confirmed with costs.

(4.)

Extract from the Annual Report of the Public Analyst for St. George, Hanover Square, for the year ended on 31st March, 1890.

Two samples of sweets were reported as adulterated. The first consisted of differently coloured balls, about half an inch in diameter. Among them were several of a brown colour. These were found to contain oxide of iron in the average proportion of 2·4 milligrammes of oxide per ball, and a mean percentage of 0.212 oxide by weight on the brown balls.

The second sample consisted of small brown and black balls, and was obtained by direction of the committee, upon the advice of the vestry's solicitors, from the same vendor who had supplied the first sample. This sample was reported as containing oxide of iron, silica and sand, and charcoal, as follows:—

Oxide of iron 0·227 per cent. on the brown balls.

Silica and sand 0·185 ,, ,,

Charcoal 0·2 per cent. on the black balls.

The use of a compound of iron as a colouring material for sweets is objectionable; such compounds might prove injurious, and no insoluble matters such as charcoal and sand should be contained in sweets in any appreciable amounts, unless (in the special case of charcoal) the fact of the admixture is stated in the name of the article.

The vendors and manufacturers of these samples were cautioned by direction of the vestry.

(5.)

Extract from the Annual Report of the Public Analyst for St. George, Hanover Square, for the year ended on 31st March, 1898.

Sweets containing oxide of iron and earthy matter.—Of the three samples of sweets reported as adulterated two contained ferruginous earthy matter insoluble in water in sufficient amount to constitute adulteration within the meaning of the Acts The particulars relating to these samples are as understated:—

(*a*) 0·806 per cent. ferruginous earthy matter insoluble in water, of which 42·18 per cent. consisted of oxide of iron (0·34 per cent. of oxide of iron in the sweets).[*]

(*b*) 0·851 per cent. of ferruginous earthy matter insoluble in water, of which 47·5 per cent. consisted of oxide of iron (0·405 per cent. of oxide of iron in the sweets).[†]

The first-named sample (*a*) was described as "Aniseed Balls"; the second (*b*) as "Caramel Beans."

A purchaser asking for "Sweets," and getting such articles as those above described, must be regarded as "prejudiced" on account of the presence of the insoluble earthy matter, and on account of the fact that the oxide of iron, present in the amounts certified, through its medicinal action is objectionable for a healthy person, and may be injurious, especially to young children, if not taken under medical direction. The Medical Officer of Health, Dr. Corfield, having been consulted prior to the institution of proceedings against the vendor of sample (*a*), adopted this view of the matter, and gave evidence in accordance therewith at the hearing of the case.

(6.)

Experiments with Solutions of Formaldehyde ("Formalin") carried out by *Charles E. Cassal*, F.I.C.

1. Shreds of gelatin were soaked in water until soft, and were placed in the following solutions of formalin (the formalin containing about 40 per cent. of formaldehyde).

(*a*) 0·5 per cent. formalin.

(*b*) 0·1 per cent. formalin.

(*c*) 0·01 per cent. formalin.

With all three solutions a marked effect is immediately produced. In one hour in the cases of solutions (*a*) and (*b*) the gelatin had become absolutely insoluble in boiling water, and was converted into a hard substance resembling brittle horn. In the case of solution (*c*) the same effects were produced after a somewhat longer time—*i.e.*, absolute insolubility and conversion into the horny condition.

2. Fresh egg albumen treated with the above mentioned solutions was converted into a gelatinous mass insoluble in cold water.

3. Digestion experiments, with Armour's pepsine and hydrochloric acid:—

(*a*) 1 gramme fibrin, 0.05 gramme pepsine, 50 cubic centimetres of water, acidified with hydrochloric acid; and *formalin* in the proportion of 0·01 per cent. on the mixture (1 in 10,000).

(*b*) Same preparation as (*a*), but *without* formalin.

Both kept at a temperature of 104° F.

After 2½ hours the fibrin in (*b*) had dissolved.

After 6 hours the fibrin in (*a*) had not dissolved, and an insoluble mass had settled at the bottom of the flasks.

(*d*) 5 grammes coagulated and comminuted egg albumen, 50 cubic centimetres of water, 0·0065 gramme pepsine, 0.4 cubic centimetre hydrochloric acid; and formalin in the proportion of 0·01 per cent. on the mixture (1 in 10,000).

(*e*) Same preparation as (*d*), but without formalin.

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[*] Vendor convicted, and fined 2*s.* 6*d.* and 2*s.* costs.

[†] Vendor convicted, and fined 5*s.* and 12*s.* 6*d.* costs.

Appendix.

Both kept at a temperature of 104° F.

After 2½ hours the albumen in (*e*) had dissolved.

After 6 hours the albumen in (*d*) had not dissolved. There was an insoluble deposit at the bottom of the flasks.

(*f*) Experiments with milk. Five cubic centimetres of milk, 50 cubic centimetres of water, 0·4 c.c. Hydrochloric acid, 0·0066 gramme pepsine, and formalin in proportion of 0·01 per cent. on the mixture.

(*g*) Same preparation as (*f*), but without formalin.

A number of similar experiments to the above were made with different quantities of milk.

The effects in these experiments were difficult to observe; but the differences between the preparations containing formalin and those free from it were quite obvious. In the preparations without formalin the curd gradually passed into solution. In the preparations containing formalin the separated curd was granular, or in hardened clots, and was plainly very difficult, if not incapable, of solution. C. E. C.

(7.)

BORACIC ACID IN CLOTTED CREAM.

Examples of amounts detected. Apart from the adulteration with Boracic Acid these samples had the composition of unadulterated cream of good quality.

CLOTTED CREAM.

	Boric Acid (as B_2O_3). Boron Trioxide. Per Cent.	Crystallised Boracic Acid (H_3BO_3). Per Cent.	Crystallised Boracic Acid (H_3BO_3). Grains Per pound.
(*a*)	0·291	0·515	36·05
(*b*)	0·262	0·464	32·48
(*c*)	0·153	0·270	18·9
(*d*)	0·138	0·244	17·08

ORDINARY CREAM.

0·184	0·3258	22·8
0·104	0·1841	12·88

(8.)

As examples of the quantities found by himself in milk the witness submits the following instances:—

Milk.

Boric Acid (as B_2O_3). Per cent.	Boric Acid (as B_2O_3) Grains per gallon.	Boracic Acid (H_3BO_3). Grains per gallon.
0·0821	59·12	100·7
0·0679	49·20	87·13
0·0611	44·0	78·0
0·0555	40·0	70·8
0·0544	39·16	69·36
0·0485	34·92	61·84
0·0456	32·88	58·23
0·045	32·4	57·38
0·0442	31·82	56·36
0·0238	17·19	30·44
0·0209	15·08	26·71
0·0188	13·56	24·01
0·0184	13·27	23·5
0·015	10·87	19·25

(9.)

EXTRACTS from the Annual Report of the Public Analyst for St. George, Hanover Square, for the year ended on the 31st March, 1896.

"BRITISH WINE" CONTAINING SALICYLIC ACID.

The three samples of so-called "British Wines" reported as adulterated contained salicylic acid in the proportions which are understated:—

(*a*) "Orange Wine," 26·6 grains per gallon of salicylic acid.

(*b*) "British Sherry Wine," 11·55 grains per gallon of salicylic acid.

(*c*) "Black Currant Wine," 4·0 grains per gallon of salicylic acid.

The remaining samples of "British Wines," consisting of three samples of "Ginger Wine," two of "Orange Wine," one of "Elder Wine," and one of "Raisin Wine," were free from salicylic acid and other chemical preservatives, and were reported as having the composition of samples which must be regarded as unadulterated, and, under existing circumstances, as not sold "to the prejudice of the purchaser," and therefore as genuine.

The vendors of the samples marked (*a*) and (*b*) were summoned by the Vestry, and in the result the summonses were dismissed.

The cases were heard by Mr. De Rutzen, at the Westminster Police Court, on the 6th November, 1895, that of the sample containing 26·6 grains per gallon of salicylic acid being taken first, and as governing the other case. Evidence in support of the Vestry's case was given by your Medical Officer of Health (Dr. Corfield) and by myself; the principal points put forward being, from the medical point of view, that salicylic acid was a potent drug, that even in very small doses its continued use would be injurious to health, and that its presence in a food in quantity sufficient to produce its specific antiseptic or "preservative" effect on that food, would, from that fact, affect the normal process of healthy digestion, and would be injurious to health. From the more strictly chemical and technical point of view the Vestry's evidence showed that salicylic acid could not be called a component part of a genuine "British Wine," that its addition was not necessary for the purpose of producing a sound and good article which would keep, that the addition of the acid might serve the purpose of concealing the inferior quality of the article or of the materials used to make it, and that, when the sample in question was analysed, seven other samples of "British Wines" were also analysed, and were found to be free from salicylic acid, and from other "chemical preservatives." A large number of witnesses were called for the defence. In this report it is unnecessary to enter into an examination of the fitness of some of these witnesses to give evidence upon such a subject, nor is it necessary to criticise the value of that evidence. It will be sufficient to state that the evidence given by the witnesses for the defence was mainly to the effect that, in their view, the presence of salicylic acid in the amount certified was not injurious to health, and that it was a necessary addition.

The magistrate reserved his decision, and on the 6th January delivered judgment in favour of the defendants, and dismisse dthe summonses in both cases, but without costs. In the course of his judgment Mr. De Rutzen observed that the only witness called to corroborate the view of the Public Analyst was Dr. Corfield. He came to the conclusion that the summonses should be dismissed on the ground that the salicylic acid present was not proved to be injurious to health, and that it was not proved to his satisfaction that it was not required for the production of the article in a fit state for consumption; the cases coming therefore, according to the evidence given, within the first proviso of the 6th section of the Sale of Food and Drugs Act.

It may be well to point out that this judgment only affects these particular cases, and that the Vestry are not precluded from again taking action in similar cases, and bringing forward additional evidence in support of them.

In commenting upon the cases, the *British Medical Journal*, the organ of the British Medical Association, made the following remarks among others: "Salicylic acid is a poison." . . . "It is no sufficient answer to accusations under section 6 of the Sale of Food and Drugs Act to prove that single large doses of a particular addition have been taken by a number of persons without injury." . . . "They" (antiseptics) "should be absolutely prohibited unless a label be placed upon everything sold after being thus treated." In a further article the *British Medical Journal* observes: "We believe that Dr. Corfield, in saying that the long-continued use of small doses of this powerful drug may be injurious to health, has on his side the support of medical experience and opinion. The decision is greatly to be regretted in the interests of public health."

APPENDIX No. XXVI.

Handed in by Mr. *Harald Faber*, as promised on Tuesday, January 16th, 1900.

APPENDIX 2, to the Report from the Committee (Landstinget), on the Manufacture and Sale of Margarine Bill, 15th February, 1896 (abbreviated).

The Royal Laboratory for Agricultural Research,
Copenhagen, 20th January, 1896.

REPORT on Experiments to Test the Keeping of Fresh Butter.

The samples of butter were procured from Kildedyb Co-operative Dairy, near Kolding; some of them were made without the addition of salt or any other preservative, while to some was added "Preservitas," the preservative mostly used, and containing 47·8 per cent. of boracic acid, 8·6 of saltpetre, 11·1 of chloride of potassium, and to others varying amounts of pure saltpetre.

Before it was decided to have the butter made at Kildedyb Dairy, it had been ascertained that the butter of that dairy was of excellent quality, and that the working of the dairy in every respect was up to date, especially as far as the production of butter free from salt was concerned, and there was therefore no reason to make any alteration in the daily working for the purpose of producing the butter intended for the experiment. The cream was pasteurised at 70° C. The dairy manager supervised the churning, &c., and every day, when butter was required for testing, he took out of the same churning four samples of about 25lbs. each. The preservatives were added during the first working of the butter.

[The butter was made on the 28th, 29th, and 30th December last year, and on the 3rd and 4th January this year. Assistants from the laboratory supervised the making, packing, and marking of the different samples.]

The butter was judged by the three particularly able butter merchants who during several years have assisted at a number of scientific judgings of butter at the laboratory. The samples were judged first time on the 7th January, second time on the 14th January, and third time on the 21st January. At each judging every judge examined all the samples independently, and gave each sample points according to the scale generally used at the State butter shows at the laboratory (Foreign Office, 1889, Miscellaneous Series, No. 151), where 15 points denotes the very finest butter, and 0 points the most inferior quality. Afterwards all three judges went over the samples together to decide finally the number of points to be given to each sample. These points for each of the three judgings of the four samples from each of the five days of manufacture are given in the table attached:—

——	Nothing added.			½ per Cent. Preservitas.			1 per Cent. Preservitas.			Saltpetre.			Amount of Saltpeter added.
	1.	2.	3.	1.	2.	3.	1.	2.	3.	1.	2.	3.	
1895:													*Per Cent.*
Dec. 28 -	10	8	7	11	9	8	11	9	8	10	9	9	1
„ 29 -	12	10	9	12	10	9	12	10	9	12	9	9	½
„ 30 -	11	8	9	11	8	9	11	9	9	11	8	9	½
1896:													
Jan. 3 -	12	9	8	12	9	8	12	10	8	12	9	8	¼
„ 4 -	11	10	8	11	10	9	11	9	9	11	9	8	¼
Average Points	11·2	9·0	8·2	11·4	9·2	8·6	11·4	9·4	8·6	11·2	8·8	8·6	–

The points obtained at the first judging show that the butter was fine. It is quite an exception for the judges at the State butter shows to give higher points than 12, which number of points therefore practically denotes extra fine quality. The points given at the second and third judging show how the different samples have kept. The greater the difference in points obtained at the subsequent judging the less has been the keeping quality of the butter. Dealing with the average points for the butter from all five days of manufacture the following has been the reduction in points:—

——	From 1st to 2nd judging.	From 2nd to 3rd judging.	From 1st to 3rd judging.
Nothing added - -	2·2	0·8	3·0
½ per cent. Preservitas	2·2	0·6	2·8
1 per cent. Preservitas	2·0	0·8	2·8
¼–1 per cent. Saltpetre	2·4	0·2	2·6

Nothing striking is revealed by these figures. The butter to which "Preservitas" was added has averagely lost about the same number of points from one judging to the next, as the butter to which nothing had been added. The addition of pure saltpetre seems to have caused a slightly smaller total loss between the first and third judging (seems to have kept the butter better), the difference, however, being very small.

[Reservation is taken as to drawing too general conclusions from this somewhat limited investigation.]

Appendix.

APPENDIX No. XXVII.

Handed in by Mr. *Harald Faber*, as promised on January 16th, 1900.

The director of the official laboratory for the examination of foods at Copenhagen having applied to the Minister of Justice with regard to the increasing use in food of preservatives, especially boracic acid and salts thereof and salicylic acid, the Minister requested the Royal Board of Health to express an opinion on the effect on health of the use of these chemicals in food, when the Royal Board of Health, in a communication to the Minister of Justice, dated 29th October, 1895, gave it as their opinion:

> "That the use in food of boracic acid and salts thereof may have an injurious effect on health when an amount of one gramme of boracic acid, or even less, is thereby daily introduced into the organism for a considerable time;
>
> "That the addition of boracic acid (and salts thereof) to foods for infants, especially milk, even in proportionally small amounts, may be dangerous;
>
> "That the use in food of salicylic acid and compounds thereof ought to be prohibited on account of their injurious effect on health."

When the law of 1894 on the official examination of foods enacted only for three years, came to the Rigsdag for revision, the Minister of Justice, during the session 1896–97, proposed the following addition to sect. 5:

> "The Minister of Justice may, by decree, prohibit the addition to food intended for sale of such chemicals which, even if they be not immediately harmful, still may by continued consumption have an injurious effect on the health of the consumer."

This passus, however, was struck off the Bill.

In the Margarine Law of 1897 it is enacted, in sect. 10:

> "The addition to butter and margarine, intended for sale, of any other preservative than common salt is prohibited; it is likewise prohibited to import, export, carry in transit or deal in butter and margarine containing any other preservative than common salt."

When this provision of the law was introduced it was explained that a similar prohibition was already found in the Belgian Law of 11th March, 1895, that the question was being discussed in Germany, Sweden, and Great Britain, that the use of preservatives was general in Australian butter, but that its effect on the health of the consumer was questionable, that no other preservative than salt was at the time used in Danish dairies, and that it was declared by experts and found at the State Butter Shows that well-made butter needed no preservatives.

In a Bill recently introduced in the Rigsdag it is proposed that:

The Minister of Agriculture may prohibit the sale and export of meat, and foods prepared from meat, containing chemicals which may be injurious to health.

APPENDIX No. XXVIII.

HANDED in by Mr. *W. Collingwood Williams*, as promised on January 19th, 1900.

Year 1899.

CITY OF LIVERPOOL. Population (1891), 517,980.

—	Borates.		Formalin.		—
Description of Samples Analysed.	Number of Samples in which Borates were found.	Percentage of Total Number Examined.	Number of Samples in which Formalin was found.	Percentage of Total Number Examined.	Sum of percentages for both Preservatives.
New Milks - -	0 out of 634	0	3 out of 634	0·5	0·5
Skimmed Milks -	8 out of 202	4·0	3 out of 202	1·5	5·5
Separated Milks -	4 out of 26	15·4	0 out of 26	0	15·4
TOTALS- - -	12 out of 862	1·4	6 out of 862	0·7	2·1

The population is from the Local Government Board Report on the Sale of Food and Drugs Act for 1899. In no sample was more than one preservative found to be present.

ADMINISTRATIVE COUNTY OF LANCASTER. Population (1891), 1,505,861.

—	Borates.*		Formalin.		—
Description of Samples Analysed.	Number of Samples in which Borates were found.	Percentage of Total Number Examined.	Number of Samples in which Formalin was found.	Percentage of Total Number Examined.	Sum of percentages for both Preservatives.
New Milks - -	2 out of 219	0·9	5 out of 416	1·2	2·1
Skimmed Milks -	0 out of 34	0	2 out of 73	2·7	2·7
TOTALS - - -	2 out of 253*	0·8	7 out of 489	1·4	2·2

The population is from the Local Government Board Report on the Sale of Food and Drugs Act for 1899. In no sample was more than one preservative found to be present.

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* Two hundred and thirty-six samples taken in rural districts during the first half of the year were not examined for borates.

APPENDIX No. XXIX.

HANDED in by Mr. *W. Collingwood Williams*, as promised on January 19th, 1900.

PRESERVATIVES IN MILK, YEAR 1899.

AREA.	City of Liverpool.	Administrative County of Lancaster.	Borough of Blackburn.	Borough of Preston.	Borough of Barrow-in-Furness.	Borough of Bootle.	Borough of Blackpool.
POPULATION - - - - - - (from Local Government Board Report on Food and Drugs Act, 1898–99.)	517,980	1,505,861	120,064	107,573	51,712	49,217	23,846
NEW MILK:							
Borates in - - - - - -	0 ex 634	2 ex 219 *	0 ex 15	0 ex 23 *	0 ex 7 *	2 ex 57	0 ex 9 *
Formalin in - - - - -	3 ex 634	5 ex 416	0 ex 15	0 ex 32	0 ex 12	1 ex 57	1 ex 15
Percentage of samples with preservatives.	0·47%	2·1%	0	0	0	5·2%	6·6%
SKIMMED MILK:							
Borates in - - - - - -	8 ex 202	0 ex 34 *	0 ex 9	0 ex 8 *	None examined *	1 ex 14	0 ex 1 *
Formalin in - - - - -	3 ex 202	2 ex 73	0 ex 9	0 ex 11	0 ex 2	0 ex 14	0 ex 6
Percentage of samples with preservatives.	5·4%	2·7%	0	0	0	7%	0
SEPARATED MILK:							
Borates in - - - - - -	4 ex 26						
Formalin in - - - - -	0 ex 26	None examined.				—	—
Percentage of samples with preservatives.	15·3%						
Total number of Milks containing preservatives	18 ex 862	2 with borate ex 253 7 with formalin ex 489 9	0	0	0	4	1
Percentage containing preservatives - - -	2·08%	0·8% with borate 1·4% with formalin 2·2%	0	0	0	5·6%	4·75%
—	—	* 197 new milks, 39 skim milks, 236 not examined for borates.	—	*9 new milk. 3 skim milks, 12 not examined for borates.	* 5 new milks, 2 skim milks, 7 not examined for borates.	—	* 6 new milks, 5 skim milks, 11 not examined for borates.

J. CAMPBELL BROWN, } *Public Analysts.*
W. COLLINGWOOD WILLIAMS, }

APPENDIX No. XXX.

HANDED in by Dr. *J. R. Kaye*, Friday, January 19th, 1900.

TABLE A.—Giving a few Examples of advertised Preservatives. *N.B.*—Many other Preparations figure in the advertisement columns of the Press, *e.g.*, "Lactosal," "Preservitas," &c. The latter is claimed to be "as harmless as common salt."

Name.	Directions for Use (converted to Grains).	Analysis.	Brief Extracts from Advertisement.
"Arcticanus" - - -	For Milk—7 grains per pint - - For Butter—31 grains per lb. For Sausage—30 grains per lb. Also recommended for Meat, Gravy, Fish, Game, Poultry, Ham, &c.	Boric Acid, 85·5 p. cent. Borax, 14.5 „ —— 100	"Medically guaranteed absolutely harmless and pure." "Extensively employed in the hotel, household, restaurant, and ship's cabin."
"Conservine" - - -	For Sausage, &c.—44 grains per lb. For Gravy, Soups, &c.—9 grains per pint. Also recommended for Meat, Game, Fish, Oysters, Ham, &c.	Boric Acid, 85·5 p. cent. Borax, 14·5 „ —— 100	"Harmless and effective." "Safe and reliable." "None need be afraid to use it."
"Burton's Household Milk and Food Preservative."	For Milk—7 grains per pint; but "for small consumers a teaspoonful will be sufficient for a quart of milk." This equals 45 grains per pint! For Cream—9 grains per pint. For Sausage—45 grains per lb. Also recommended for Meat, Fish, Game, &c.	Boric Acid, 100 p. cent.	"Harmless and effectual."
"Coverdale's Meat Preserver."	For Milk—4 grains per pint - - Also recommended for Butter, Eggs, Meat, Fish, Game, &c.	Boric Acid, 100 p. cent.	——
"Ramsden's Milk Preservative."	For Milk—11 grains per pint - - For Butter—125 grains per lb. ! Also recommended for Fish, Meat, &c.	Not analysed - -	"Totally harmless to the most delicate child."

TABLE B.—Showing the Infantile Mortality in England and Wales (compiled from the Registrar General's Returns) during the twenty years 1878–1897, arranged in five-yearly periods, with some figures as to the growing Loss of Infant Life. For comparison, the general Death Rate of the same periods is also shown.

Five-yearly Period. (1.)	Number of Deaths of Infants under One Year per 1,000 Births. (2.)	(3.) Corresponding to the following increased loss of Infant life in actual numbers.	General Death Rate per 1,000 Living (all ages). (4.)
1878–82 - - - -	**142**		**20·3**
1883–87 - - - -	**143**	4,481	**19·4**
1888–92 - - - -	**146**	17,788	**19·0**
1893–97 - - - -	**152**	45,641	**17·8**

TABLE C.—Displaying the rates of Infantile Mortality during one eight-year period (1891–1898) in England and Wales and various parts of the country. Also the quarterly distribution of the same

——	Number of Infant Deaths (under One Year) per 1,000 Births. —— Eight Years 1891–98.	Quarterly Distribution of such Infant Deaths. Average of Eight First Quarters.	Average of Eight Second Quarters.	Average of Eight Third Quarters.	Average of Eight Fourth Quarters.
England and Wales - - - - -	152	147	129	183	150
Thirty-three Large Towns - -	171	152	141	229	163
The Five County Boroughs in the West Riding of Yorkshire.	176	154	147	239	165
West Riding Administrative County	154	145	139	171	161

It can also be shown, from the detailed records of the same period, that, while the excessive infantile mortality of the Third Quarters became relatively greater in the later years of the period, there was an improvement in the First and Second Quarters.

APPENDIX No. XXXI.

Handed in by Mr. *H. Droop Richmond*, on Monday, January 22nd, 1900.

DETAILED ANALYSIS of COMMERCIAL PRESERVATIVE which have come directly under the notice of the Aylesbury Dairy Company, Limited.

(1.)

Name.	Data Estimated. Per cent.			Results calculated as per cent.	
	Total B_2O_3.	Free B_2O_3.	$Na_2B_4O_7$.	H_3BO_3.	NO $10OH_2$.
1. Sal Preservare -	53·1	42·6	15·15	75·5	28·6
2. Douglas - -	59·0	42·5	23·8	75·2	45·0
3. Tomlinson -	54·8	51·9	4·1	91·9	7·7
4. Boraciline -	55·8	47·5	12·0	84·1	22·7
5 Semper Dulcis -	58·05	43·5	21·0	77·0	39·7
6. Neigeine - -	56·9	51·6	7·6	91·5	14·4
7. Dr. Beesly's -	56·6	56·6	—	100·3	—
8. Rex Magnus -	57·1	42·1	21·7	74·6	44·2
9. Preservitas -	58·1	39·5	26·8	70·0	50·7
10. Salvo - -	58·55	44·65	20·1	79·1	38·0
Average - -	56·8 %	—	—	—	—

Health Guard contained boric acid combined with soda, and salicylic acid.

D D contained about 12½ per cent. free boric acid (calculated as B_2O_3) and about 13 per cent. salicylic acid combined with soda and magnesia in glycerine solution; a bitter principle (unidentified) was also present.

(2.)

TABLE of Percentages of Boric Preservative in Butters.

French Butters.

——	B_2O_3 per cent.	Commercial Preservative per cent.
Maximum - - -	0·398	0·70
Minimum - - -	0·305	0·54
Average - - -	0·336	0·599

Butters washed with Boric Acid Solution.

——	B_2O_3 per cent.	Commercial Preservative per cent.
Maximum - - -	0·094	0·17
Minimum - - -	0·042	0·076
Average - - -	0·076	0·136

Note.—The commercial preservative is calculated from the B_2O_3 estimated by dividing by 0·568.

(3.)

TABLE of the Length of Time in Hours that Milk will keep at various temperatures when Preservatives are added.

Temperature. °F.	Preservative added to Milk: Per cent.					
	None.	Boric Preservative.		Formaldehyde.		
		0·05	0·10	0·0023	0·0047	0·0093
	TIME IN HOURS.					
60*	50	84	110	60	100	140
70	34	43	54	40	58	92
80	22	26	36	29	40	66
90	15	18	27	18	31	52
100*	9	12	23	11	27	44

TABLE of Additional Time which Milk will keep Sweet when Preservatives are added.

Temperature. °F.	Preservative added to Milk: Per cent.				
	Boric Preservative.		Formaldehyde.		
	0·05	0·10	0·0023	0·0047	0·0093
	TIME IN HOURS.				
60*	34	60	10	50	90
70	9	20	6	24	58
80	4	14	7	18	44
90	3	12	3	16	37
100*	3	14	2	18	35

* The values at these temperatures were obtained by extrapolation.

It is assumed that milk turns sour when an increase of the acidity of 25° has taken place (*i.e.*, 100 c.c. of milk require 25 c.c. more N/10 soda solution to neutralise to phenolphthalein than when quite fresh).

It is assumed that, to be of any appreciable use, preservative should increase the "life" of the milk by 12 hours at 80°–90° (hottest summer temperature) on this basis:

0·09 per cent. boric preservative, and
0·004 per cent. formaldehyde are the minimum amounts necessary in summer.

APPENDIX No. XXXII.

Handed in by Mr. *H. Droop Richmond*, as promised on January 22nd, 1900.

Experiments on the use of hydrofluoric acid as a preservative of milk samples were published in "The Analyst" (1889–99). Hydrofluoric acid when added to fresh milk in the proportion of 0·5 per cent. was found to keep the samples in such condition that they gave the same results on analysis at times varying from a month to a year after the addition. If the milk had commenced to turn before the addition, the results were not so good. Carbon bisulphide, ether, dichlorophenol, chloroform and terpenes added to the same amount were unsatisfactory.

Further experiments in conjunction with L. K. Boseley ("Analyst" 1897–98) showed that chloroform was a better preservative than boric acid, and thus it is indirectly shown that hydrofluoric acid is much better in its preservative action than boric acid.

A few experiments were made with Fluoboric Acid cream. About 0·02 to 0·03 per cent. was found to have an appreciable action as a preservative, and though accurate comparisons were not made, it was judged that fluoboric acid was at least five times more powerful in its action than boric acid.

Sodium fluosilicate was also experimented with, but was found to be too insoluble to be useful as a preservative.

APPENDIX No. XXXIII.

Handed in by Mr. *J. M. Harris*, on Monday, January 22nd, 1900.

Laboratory, Plough Court,
37, Lombard Street, London, E.C.,
22 January 1900.

Dear Sir,

On the 21st November, 1899, I received from you two gammons of English bacon to be tested for boric acid. Later I received from you a gammon of Davies' Canadian Pea-Fed.

There was no difficulty in ascertaining the presence of boric acid in the fat and flesh near the surface. In order to ascertain to what extent it had penetrated a piece was in each case cut from about the middle, near the bone.

The following results were obtained :—

—	First Gammon, Harris's.	Second Gammon, Oake, Woods & Co.	Third Gammon, Davies' Pea-Fed Canadian.
Boric Acid - -	·13 per cent.	·10 per cent.	·12 per cent.
Equivalent to Borax per lb. of meat.	14·1 grains	10·5 grains	12·6 grains

In each case borax could be readily detected on the outside.

A piece of fresh pork experimented upon in this laboratory showed boric acid in the interior of the flesh after the lapse of one week, to the extent of ·10 per cent, equal to 10·5 grains of borax per pound of meat.

Yours faithfully,

R. H. Harland.

J. King Stewart, Esq.,
The Bacon-Curers' Association of
Great Britain and Ireland.

APPENDIX No. XXXIV.

Handed in by Dr. *Philip Schidrowitz*, on May 8th, 1900.

The Use of Preservatives in Beer.

The great increase in competition in the brewing trade that has taken place in recent times, coupled with the huge sums which brewers are under present conditions practically compelled to expend on tied houses in order to maintain their positions in the trade, are, in my opinion indirectly the chief reasons which account for the almost universal use of preservatives in brewing which now obtains. Brewers have largely sought to meet the altered conditions by increasing their turnover—that is to say, by obtaining more beer from a plant of equal capacity than formerly, and this tendency has led to a very considerable reduction in the brewing time and also in the gravity of the beer brewed. It is by no means uncommon for a beer to be sent out of the brewery into consumption within a week or ten days from the time of mashing, and, working under these conditions, it is difficult to produce a good keeping beer without the use of preservatives. If such a beer were sent out "unpreserved," it would in the majority of cases deteriorate very rapidly, and it is hardly unfair, therefore, to say that one of the chief objects of the use of preservatives in the brewing trade is to mask actual defects in brewing.[1] Without prejudice to the question as to whether the use of preservatives is or is not harmful, or should or should not be prohibited, I am of opinion that if the use of preservatives in beer was prohibited, brewers would, broadly speaking, be forced to brew a better article[2] and the consumer would be a distinct gainer thereby.

Whether injury to health is likely to arise from the preservatives used in brewing obviously depends on the quantity and frequency of the dose, but whether injurious or not, the use of preservatives must be considered to constitute a fraud where they are used to conceal the inferior character or manufacture of an article.

In view of the enormous consumption of beer in this country, amounting in 1899 to roughly thirty-one gallons per head of population, it is obvious that the use or abuse of preservatives in beer is a question of considerable importance. Beer is not a food in the ordinary sense of the word, but it has considerable food value, and the consumption is so great that its albuminous and carbohydrate constituents form an appreciable percentage of the total proteid and carbohydrate food of the nation. By a simple calculation I arrive at the fact that roughly 2 to 3 per cent. of the total albumen and 5 per cent. of the total carbohydrate food of the adult population is taken in the shape of beer. A man drinking, say, four pints of beer a day, and consuming one and a quarter pounds of bread, and three-quarters of a pound of meat would (according to a calculation of Voit) take about 10 per cent. of the proteids and 20 per cent. of the carbohydrates in the beer alone.

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[1] Beer Materials Committee—Grummit, 911; Wells, 1916.
[2] Beer Materials Committee—Stopes, 3373, 3250–3258.

The preservatives chiefly used in beer are—

1. The Sulphites (chiefly bisulphite of lime).
2. Salicylic acid.
3. More recently and in smaller measure Benzoic acid and the Fluorides.

I do not think that Formaldehyde is ever used in beer, and Boric acid very rarely, if at all.

With regard to *Salicylic acid* there can be little doubt in face of the evidence given before the Beer Materials Committee that it is used to a considerable extent. One witness[1] expressed it as his opinion that its use was abandoned ten years ago, but Mr. Bannister (late Deputy Principal of the Inland Revenue Laboratory) stated that it was used.[2] Sir J. H. Gilbert, examining Mr. Stopes[3], said "With regard to the use of salicylic acid and bisulphite of lime, I think it is admitted that they are extremely largely used in Burton. . . ." Mr. Stopes[4] stated that salicylic acid is used by a number of brewers, and that he was told by a vendor of salicylic acid that he had 800 brewers on his books. Mr. Cassal[5] stated that he had prosecuted and obtained convictions for salicylic acid in beer. I was myself informed by the largest makers of salicylic acid in the world that their sales would fall off by a quarter if the use of this article were prohibited, and until quite recently there was a stall at the Brewers' Exhibition on which the wares of a well-known maker of the acid were prominently displayed. Some recent investigations carried out by the Connecticut Experiment Station showed that among a number of preservatives recommended for wine and beer one consisted entirely of salicylic acid, and another contained free salicylic acid 27·12 per cent. mixed with salicyate of soda and carbonate of soda.

It is stated that about one part of salicylic acid to ten thousand is sufficient to preserve beer, but there is reason to believe[6] that under some conditions this would hardly be sufficient. On this basis, however, a man drinking four pints a day would consume about 0·3 grammes, or 5 grains of salicylic acid. The use of salicylic acid (as of all other preservatives) in beer is prohibited in Germany, but it may be put into beer intended for exportation. The use of salicyclic acid is prohibited in France.

Sulphites.—The very general (for running beers almost universal) use of sulphurous acid, or rather its salts (principally the bisulphite of lime and the bisulphite of potash) is admitted on all hands. With regard to the quantity employed, Dr. Moritz[7] stated that the monosulphite is used in proportion to one ounce to the barrel (about one to five thousand), and the bisulphite a quarter to a half pint per barrel, but it is undoubtedly often used in much larger quantities.[8]

Sulphites are probably the least objectionable preservatives, but where used in excess or to mask deficiences in the malting or brewing their use must obviously be condemned. They occasionally give rise to "stench" in beer owing to the reduction of the sulphite to sulphide by bacterial action. It is alleged that sulphites speedily become oxidised to sulphates, and, therefore, even if the former do exercise any prejudicial action on the human economy, it is a matter of little importance, as by the time the beer reaches the consumer the sulphite has become converted. This, however, is not the case with bottled beers, nor in cases where sulphites are used in anything like appreciable quantities in draught beer.

Artificial hop bitters are used to some extent in brewing. They are not used primarily as preservatives, but they certainly exercise a preservative action. They consist mostly of quassia and other natural bitters, and I think that their unrestricted and undeclared use is most undesirable. A substance which, I think, should be entirely prohibited is *Quillaia Bark.* (B.M.C. Minority Report—footnote. Hehner 7305. Mr. Bannister's list etc.)

Speaking broadly, I believe that the use of antiseptics in the manufacture of beer to be unnecessary when the same is produced on rational lines and from sound material[9], and that the facilities for quick brewing afforded by their use are very often abused to mask inferior materials and bad brewing. I think that if the use of preservatives in beer were prohibited, or restricted, and declaration enforced, the consumer would be an appreciable gainer thereby.

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[1] 5176. [2] 6476. [3] 371. [4] 3521. [5] 4666.

[6] French Commission, 1880—Andès, Die Conservirung der Nahrungsmittel, 1894.

[7] 5176. [8] Stopes, 3519. [9] 3373, 3250–3258.

Appendix.

APPENDIX No. XXXV.

Handed in by Dr. *Philip Schidrowitz* on Tuesday, May 8th, 1900.

I.—The mixed (evening) milk of eight healthy cows (two Jerseys and six Shorthorns) on a diet of mangels, hay, barley meal, and equal parts of cotton and linseed cake, was strained and then rapidly cooled to 10·5°C. The milk was then brought up to London by myself in the water-jacketed tin alluded to above. Maximum temperature attained by milk prior to starting experiments 10·5°C. Experiments started 19 hours after milking. Initial acidity of milk 14·7 degrees.

a = time after incubation. b = time after milking (hours.)

Blank (No Preservative.)				Formaldehyde 1 : 50,000.		Formaldehyde 1 : 25,000.		Boric Acid 1 : 3,000.		Boric Acid 1 : 2,000.	
Time.		Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.
a.	b.						KEPT AT 15°C.				
5	24	14·7	—	14·7	—	14·9	—	14·7	—	14·7	
22	41	14·7	—	14·7	—	14·8	—	14·7	—	14·9	
29	48	14·8	—	14·8	—	14·6	—	14·8	—	15·1	
47	66	26·5	Coagulates in boiling water, but not unpleasant.	18·3	—	14·4	—	16·3	—	14·8	
53	72	—	—	24·1	Did not coagulate.	14·4	—	18·5	—	15·9	
70	89	—	—	49·9	Coagulates -	14·4	—	33·5	Coagulates -	25·3	Coagulates.
							KEPT AT 25°C.				
5	24	15·1	—	15·1	—	15·1	—	14·8	—	14 9	
22	41	43·0	—	17·1	—	15·1	—	22·0	—	18·3	
29	48	—	—	32·0	—	15·8	—	51·0	—	36·6	
47	66	—	—	—	—	36·2	Curdled - -	—	—	--	

II.—Mixed (morning) milk of same eight cows as in I. Milking vessels scalded immediately prior to milking. Cooled to 10·5°C as before. Maximum temperature of milk prior to experiments 11°C. Experiments started 10½ hours after milking. Initial acidity 14·7 degrees.

a = time after incubation. b = time after milking.

Blank (No Preservative.)				Formaldehyde 1 : 50,000.		Formaldehyde 1 : 25,000.		Boric Acid 1 : 3,000.		Boric Acid 1 : 2,000.	
Time.		Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.
a.	b.						KEPT AT 15°C.				
16½	27	14·8	—	14·4		14·8		15·3	—	15·2	
23½	34	14·4	—	14·4		14·4		14·9	—	15·6	
40½	51	14·8	—	14·8		14·8		15·4	—	15·6	
47½	58	19·9	No (or only very slight) odour.	15·4	No odour -	14·8	Very slight odour.	15·3	Very slight odour.	15·4	Slight odour.
64½	75	43·0	Coagulates, but no exceptional odour.	17·2	Very slight odour.	14·8	Slight odour -	21·5	Slight odour	17·1	Slight odour.
71½	82	—	—	23·0	Smells cheesy, but does not coagulate.	15·1	Slight odour -	32·2	Coagulates: slight "turned" odour.	21·6	Distinct odour.
88½	99	—	—	—	Curdled - .	16·1	Slight odour -	—	—	—	Curdled.
136½	147	—	—	—	—	—	Curdled -	—	—	—	
							KEPT AT 25°C.				
16½	27	15·1	—	14·8		15·1		15·1	—	15·6	
23½	34	24	Does not coagulate.	15·8		14·8		19·6	—	17·1	
40½	51	—	Curdled, but no unpleasant odour.	41·3	Coagulates: slight odour.	18·9	Smells badly, but does not coagulate.	—	Curdled, smelt	67·1	Not curdled but smells badly.
47½	58	—	—	—	—	34·4	Almost curdled, smell disappeared.	—	—	—	

NOTE.—The odour (and smell) referred to in above table was of a peculiar bitter nature, and not at all like the ordinary odour of "turned" milk.

III.—Mixed (morning) milk of same cows as in I and II. Milk not cooled in any way. Otherwise as in I and II. Maximum temperature prior to experiments 29·5°C. Minimum do. 22·0°C. Experiments started 10 hours after milking. Initial acidity 16·1 degrees.

a = time after incubation. b = do. after milking.

Blank (No Preservative.)				Formaldehyde 1 : 50,000.		Formaldehyde 1 : 25,000.		Boric Acid 1 : 3,000.		Boric Acid 1 : 2,000.	
Time.		Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.	Acidity.	Remarks.
h.	b.						KEPT AT 15°C.				
17	27	24·7	Does not coagulate.	16·5	—	16·1	—	20·6	—	19·1	
(20	30	31·6	Coagulates -	—	—	—	—	22·7)	—	—	
24	34	—	—	17·2	—	16·5	—	28·9	Coagulates -	24·1	Does not coagulate.
41	51	—	—	18·2	—	15·8	—	—	—	46·4	Coagulates.
48	58	—	—	25·1	Smells sour and changed, but does not coagulate.	15·8	-	—	—	—	
89	99	—	—	—	—	21·3	Very slight odour.	—	—	—	
96	106	—	—	—	—	29·24	Sour - -	—	—	—	
							KEPT AT 25°C.				
17	27	—	Curdled - -	23·4	—	18·9	—	—	Curdled - -	—	Curdled.
(20	30	—	—	31·0	Coagulates) -	—	—	—	—	—	
24	34	—	—	—	—	21·0	—	—	—	—	
41	51	—	—	—	—	37·8	Coagulates -	—	—	—	

APPENDIX No. XXXVI.

MEMORANDUM on the Use of Preservatives in Dairy Produce, by Mr. *John Boyd Kinnear.*

IN any enquiry whether so-called preservatives are injurious to health there is the previous question whether they are at all necessary. From a tolerably large practical experience in the matter of dairy products, I am able to answer that question in the negative.

For some dozen years I have kept on some farms in my own hands a herd of about 120 cows of pure Guernsey breed. Their milk is chiefly sold in two shops belonging to me, one in St. Andrews, 20 miles distant by rail, the other in Edinburgh 40 miles distant. What is not sold as new milk, cream, or skim, is churned, and the butter is sold as fresh at the same shops. I am therefore brought into direct contact with every consumer, and I hear with great promptitude of any defect occurring in any article.

As the milk is of specially high quality, and is sold at a price above the usual rate in both towns, the customers are even more than usually particular in reminding me, quite justly, that for a high price they are entitled to perfect milk.

But this standard I have been able to attain (subject to extremely rare exceptions, always traceable to some accidental negligence) without the use of any preservatives either in summer or winter. This success is due to observance of the condition of scrupulous cleanliness in the cows, in their surroundings, in the milkers, and in the milk vessels. Further the milk is generally refrigerated in the usual well-known method. But I have found by an experience of three summers, that the main virtue of refrigeration is not the cooling, but the exposure to the atmosphere in a thin stream when freshly drawn from the cow. A wire gauze is supplied for this purpose by Gray of Stranraer, and I find that milk poured over this gauze and sent off only slightly cooled keeps as well as that which has been fully cooled. It is equally well deprived of the animal odour, and it would seem that this effects the removal of the primary element of decomposition.

The points in which special cleanliness is observed are briefly these. The byres or sheds are open to the roof and thoroughly ventilated, while most of them are lighted by skylights, which give a much stronger light than side windows. The floors are of concrete, and passages and gutters are daily washed till the water runs perfectly clear. The droppings are drawn back from the cows frequently, so that at least during the day they do not soil themselves, and twice a day the dung is carried out in wheelbarrows, while the urine flows at once into an outside tank. Every morning the first work is to wash such of the cows as have dirtied themselves in the night, and, besides this, every milker washes the teats of each cow in a basin of clean water before each milking. The milkers themselves are provided with clean white aprons. Thus no dust or impurity either from the cows, the litter, or the milker's dress can enter the pails. The cows themselves are brushed daily during the forenoon. The atmosphere of the byres is at all times as sweet as that of a drawing-room.

The usual precautions of washing and scalding all utensils are of course observed. It may be observed that any occasional case of premature acidity in the milk can always be traced to some neglect in the purification of the cans, such as using water for scalding that is not quite boiling.

Under these conditions milk may be depended on to keep sweet for 24 hours, even in the height of summer and subject to the disadvantage of a slow railway journey. In exceptionally hot weather the cans are covered with a wet woollen jacket when despatched. Ice is not employed; but this article, now so cheap, would afford an additional means of preservation, if requisite. It is a fact that weather in Scotland is never so hot as it is in certain summers in England, but ice would be more than sufficient to meet this difference, and if the trade were to combine they could oblige the railway companies to provide cool vans, as for meat.

It may therefore be stated with confidence that no antiseptics are necessary for conducting dairy operations, provided perfect cleanliness is enforced.

Apart from the question whether the use of antiseptics is injurious to health, there is the distinct objection to them that they mask uncleanliness. Filth from the cows, from their litter, from the dress of the milkers, may all pass into the milk and be swallowed with it undetected, if antiseptics are used to prevent the natural action of such filth in setting up decomposition. In the interest of purity alone they ought therefore to be interdicted.

It must, however, be conceded that the conditions of cleanliness do involve a certain expense, and therefore may involve a rise of price. This holds true of all articles and not of milk and butter only. And as there is a certain number of people who prefer cheapness to purity, it may be proper to permit the continuance, at their own risk, of the use of antiseptics in articles of food. But at least they ought to be informed, so that they may make their choice. All articles which are thus preserved ought therefore to be distinctly labelled "Preserved," and the packet or vessel in which they are handed to a purchaser ought to have such a label affixed to it. Exception may be made of such preservatives as declare themselves by their taste or smell, and which are at present recognised as harmless, such as salt, sugar, vinegar, alcohol, wood smoke, or substances derived from distillation of wood. But all other antiseptics should be allowed only if expressly notified to the purchaser.

The same rule should be applied to colouring materials. They are used for the purpose of representing an article to be what it is not. If any purchaser likes his food thus dyed by all means let him have it. But at least everyone should have his choice. The word "Coloured" should be required to be affixed to all articles of food thus artificially stained when offered for sale. No one can object to such a rule except in the interest of fraud. The plain rule of honesty is that every customer should know exactly what he is buying; if the trader tries by antiseptics or colouring to represent an article as fresh when it is not, or as having a natural colour when it is artificial, the law should certainly declare the attempt to be an offence.

PRECIS OF EVIDENCE.

Anderson, Mr. Alexr. Richard. (Digest of his Evidence.)

F.R.C.S., 7184, and Surgeon to Nottingham General Hospital, 7185.

Boracic acid prescribed by witness, 7186, 7210, and its effects observed, 7187. From 30 to 60 grains daily for bladder disease have frequently caused dyspeptic disturbances sufficient to cause misery, the symptoms quickly subsiding on the acid being given up, 7188. The acid is an irritant, and therefore bad in typhoid fever, 7190. It is a very feeble antiseptic, 7191. No evidence of skin eruptions from antiseptic use of the acid, 7192. No practical experience of harm from boracised food, 7203. Serious dyspeptic trouble likely to accrue to child taking 10 grains a day in milk, 7204. Should not be used indiscriminately in milk, 7207. Boracic acid treatment of infantile diarrhœa would be bad, 7213-15.

Contra-indication of boracic acid in fevers, 7205-6, and in all disorders entailing milk diet, 7208. Would not give the acid in nephritis, 7209.

Salicylic acid, as salicylate of soda, produces distinctly unpleasant symptoms, 7211-12.

Prohibition of boracic acid in milk urged on account of harmfulness to children and also adults in ill-health, 7189.

Medical men should know if patients are taking drugs in their food, 7197, 7204. Their position might be stultified, 7198. Harm caused by milk in one instance, 7198-7202.

Milk of Nottingham General Hospital tested for preservatives, 7193-96.

Annett, Dr. Henry Edward. (Digest of his Evidence.)

Doctor of Medicine, Diplomate in Public Health, Demonstrator in Tropical Medicine and Pathology, 2634-35.

Experiments made as to formalin and boracic acid in milk, 2636, and these preservatives found, 2637-39. Formaldehyde in milk, $\frac{1}{50000}$, retards the growth of kittens, 2640-41. In $\frac{1}{25000}$ still greater retardation of growth results, and still greater in $\frac{1}{12500}$, 2641. Boracised kittens with 80 grains of boracic acid to a gallon of milk, and 40 grains also, became emaciated and died, 2647. They had diarrhœa, 2648. Balance of unassimilated nutriment probably voided, 2649. Control kittens used, 2650. Amount of boracic acid taken by kittens not known; all had unstinted milk supply, 2653, 2655, 2690. Matter unimportant, 2654. Ten boracised kittens took about a quart of milk per diem, 2656-59. Kittens hardly susceptible to boracic acid after three months old, 2660, 2662, 2671-72, 2694, 2704. Susceptibility decreases gradually, 2695. Reason unknown, 2698-2701. *Vice versâ* experiments on kittens not attempted, 2660-61. Relative immunity of infants not known, 2696. Drs. Rideal and Foulerton used older kittens, hence results differed, 2663, 2691-93. Chittenden's experiments were made on full-grown dogs, and also and for that reason differed, 2664. Experiments of witness lend argument to effect of boracic acid on infants only, 2666. Investigation on young animals to be preferred to adult animals and to experiments *in vitro*, 2673-74. No experiments made on kittens fed normally up to three months, 2703. Dr. Foulerton obtained no result with kittens of that age drinking boracised milk, 2705.

Animals insusceptible to anthrax not known, 2669. Susceptibilities of mice to anthrax known, 2670.

Formaldehyde as a preservative in milk not always effective for 48 hours in $\frac{1}{50000}$, nor for 24 hours in $\frac{1}{25000}$; but $\frac{1}{12500}$ does preserve it for 48 hours, 2642. About one-third of tumbler used in experiments, 2643-44.

Précis.

Injurious effects of preservatives in milk, formalin and boracic acid, in proportions used in kitten experiments, held to be decided as regards infants, 2651-52. As regards adults, effects probably idiosyncratic, 2666. Thirty grains per diem known to have produced severe symptoms, 2667. Kittens, like infants, dependent on milk diet, 2668.

Digestive disturbances of preservatives not clearly defined. No doubt there is considerable inhibitory action on enzymes, 2697.

Diarrhœa mortality in infants probably related to preservatised milk, 2675-80.

Prohibition of preservatives in milk needed; they admit of its manipulation and of general uncleanliness, 2685, and would tax infants' digestive powers, 2689.

Milk, keeping power in large quantities not known, 2645-46. Boracic acid, in proportion of 35 grains per gallon, believed to be deemed requisite to keep milk for 48 hours, 2647. Milk should be preservatised soon after drawn, 2681. Acidity as a full indication of decomposition of milk not known, 2683-84. Sour milk injurious to infants, 2685. Veiling of decomposition by added boracic acid not known, 2686, but not likely, 2687-88.

Attfield, Prof. John. (Digest of his Evidence.)

Doctor of Philosophy, F.R.S., Professor of Practical Chemistry, Editor of the British Pharmacopœia, &c., 6491-94, 6532.

Physiological action of modern preservatives studied, 6495, as used by witness for personal dyspepsia under medical advice, 6496. Boracic acid taken, from 10 to 15 grains thrice daily, as sufficing to prevent abnormal stomachic decomposition of food, 6497, but larger doses have been taken, though 10 grains found sufficient, 6497-98. As much as 70 grains daily taken experimentally, 6499. No inconvenience resulted, 6500. Boracic acid voided through the kidneys, 6501, how much daily not known. The acid peppered on fibrous food at meal-times, 6502, 6513-15. No bad effects on digestibility of food noticed, 6503-4, rather the reverse, 6505-6, 6512. Action of certain bacteria inhibited, 6507-9. Stomach washed out and contents examined, 6502, 6510-11. Nothing much to be learned from bacteriological examination of the contents, 6516-19. Retardation of digestion of salted and smoked foods not due to antiseptics, 6520. Formalin never taken, 6521. Sodium hyposulphite taken, from 15 to 45 grains per diem, prevented discomfort attending fibrous foods, but at times unpleasantness resulted, 6539-44, but experience not of same value as that with boracic acid, 6545. Inhibitory action of preservatives on bacteria of decomposition, and therefore also on digestion, not true in witness's judgment, 6546. Conceivable that infants may suffer from preservatised milk; no evidence of such suffering in witness's possession; and Dr. Bell gives evidence to the contrary, 6552-54. A question of quantity arises, 6555-56. Desirable to know the quantity of boracic acid being taken with food, 6557, but matter not of great importance, 6558-59.

Salt scarcely more a food than boracic acid, 6549, but it is a component of the human body, 6550. Salt betrays its presence in food, 6551.

Salicylic acid may be taken from 5 to 15 grains at a time without retarding digestion, 6568.

Formalin has an extremely hardening effect on gelatin in strong proportions, 6521-30, 6566, of 40 per cent. solution, 6531. As a constituent of food action not known, 6567.

Boracic acid dose reduced in Pharmacopœia because present dosage produces all needed effects, 6533-35, and larger doses do no more, 6536. Has taken 100 grains in one day, 6537, and has kept up

Précis.

45 grains daily for weeks, 6538. Boracic acid found in many vegetables, in wines, and hop plant, 6550. Boracic acid has no flavour, 6551. Eighty grains to the pint of milk a very large dose, 6560-61, but probably an isolated case, 6562.

Declaration of preservatives not objected to, if and so far as practicable, 6547.

Prohibition of indiscriminate use of boracic acid should be enforced if large doses are put into milk, 6562-65, and objection lies to the indiscriminate use of formalin, 6567.

Idiosyncrasy a matter of importance *quâ* preservatives, 6569.

Colouring matters of a harmful character not come across, 6570-71. Common knowledge that some harmful substances are used, 6572. Copper found only in very minute amounts in vegetables and jams as regards a particular firm, and inference drawn of accidental admixture by method of manufacture, 6573.

Bannister, Mr. Richard. (Digest of his Evidence.)

Late Deputy Principal of the Inland Revenue Branch of the Government Laboratory, and a Fellow of the Institute of Chemistry and Chemical Society, 3482-83.

Bacon preserved with borax after cure with salt and saltpetre, 3484, and ham also in England, 3648. Bacon can thus be mild cured, 3485, and is not imported in other ways, 3486. Packing in borax is inexpensive, 3488. Refrigeration would be more expensive, 3489-94. Bacon packed in borax not known to have been harmful, 3494. Borax a necessity to the bacon trade, 3495-96, 3498-3500, owing to change of public taste. Rancid bacon no longer saleable, 3497. Bacon brought in as is fresh meat would not be in same condition as borax-packed bacon, 3501. Necessary for mild-cured bacon and ham to have from 4 ozs. to 1 lb. of boracic acid per 112 lbs. of meat, 3649-51, in powdered form, 3652-53.

Meat is imported fresh in refrigerators, 3487. If kept it is dusted with borax, 3626.

Refrigeration involves expense, 3488.

Butter trade to-day demands a preservative, 3502-3, 3532, as regards factory and creamery butter, 3536-37. Creamery butter without preservatives goes off quickly, 3538, and many factories use them, 3539. If for quick consumption preservatives not a necessity, but necessary if the butter required to keep, 3540. Necessity not universal, 3541, even in creamery butter, 3542-43. Danish butter contains only salt, but cannot compete with Normandy fresh, 3504. Latter fetches a higher price, 3505. About 2 per cent. of salt in Danish butter, 3506, but amount varies, 3507-8. Finest quality under 2 per cent, 3509-12, but very best class not over 1 per cent., 3513. Danish is tub butter, Normandy is factory butter, 3513-14. Danish butter compares with the old Irish butter, 3515, which was salty, 3516, and tub butter, 3517-18. Danish butter a substitute therefor, 3519-20. Some Irish butter equal or superior to Danish, 3521. Some old Irish butter was not heavily salted, 3522, 3530-31, made in summer, 3523, without abnormal quantity of water, 3524-26, with exception, 3527-29. Irish butter lost the market by being only a seasonal trade, 3533, Denmark stepping in with an all-year-round trade, 3534, and with its unpreservatised butter driving Ireland out, 3535. Normandy butter contains either salt or preservative, 3544-45. Butter refrigerated decomposes readily on defrosting, 3626-27.

Milk sour probably more harmful than boracised milk, 3546. Prevalence of preservatising of London milk not known, 3547; nor proportion in milk, 3548. Diffusion of preservatives in milk may be partial, 3631-32; but this no argument against their indiscriminate use, 3633; but there might be danger of over-dose of boracic acid in some portion of the milk, 3634. Simple declaration would not cover this risk, 3635. Sixty grains of boracic acid have been found in a gallon of milk, 3636. Eighty grains per pint would taste the milk, 3637-38, 3640. Such a quantity should be declared, 3639; it counterbalances any trade requirement, 3640. Boracic acid a seasonal necessity in milk trade, 3641. Great difficulty in carrying on milk trade of a large town in summer else, 3642-44. A small number of samples examined does not represent Birmingham milk, 3645-46. If only 9 per cent. of milk there is preservatised no great commercial necessity for milk preservative, 3647. Decomposed and sour milk a danger *quâ* disease and infantile mortality, 3654, diarrhœa and wasting, 3655. Some of the diarrhœa doubtless due to preservatives, 3656-57. Boracic acid prejudicial to children's health, 3658. Milk should not be formalised, 3660.

Copper in peas, as used in France, need not be prohibited. Coppered peas command a large sale, 3560. It preserves their natural colour, 3561-68, but old peas are not used, 3569. It recolours peas that are off colour, 3570. No fraud in question, 3571-72. Public demand the colouring, 3573-74. Consumer not prejudiced by the practice, 3575-80. Copper albuminate not dissolved during digestion, 3581-85. Reason not known, 3586. No harm known from consumption of coppered peas, 3587-89, 3608-11. Copper is a poison in large quantities, 3590, but not known to be cumulative, 3591. Declaration of presence of copper would seldom meet consumer's eye, 3592. Such peas mostly used in large establishments, 3593. Too much copper cannot be put in without spoiling the peas, 3597, and $\frac{1}{10000}$ is the most found; $\frac{1}{7700}$ being regarded as a fair average by French Government, who have not interdicted the practice, 3598. Mode of diffusion of copper in peas not known, 3599, but thought of as general, 3600. Some think copper is associated with the chlorophyll of the pea, 3601, outside the pea, 3602-4, tending to its concentration, 3605. Physiological action of eating coppered peas not known, 3606-7. About $\frac{1}{10000}$, or 2·9 grains of commercial copper sulphate per lb. of peas would be a safe amount, 3612. Copper sulphate used as an astringent in doses under a grain, 3613. But action in peas is not known, 3614-18. Ten grains per lb. of copper sulphate never found, 3619, because copper not there as a sulphate, 3620-25.

Beer preservatised most often by sulphurous acid, 3661, 3668-70, in small quantity. Also used for cleaning brewery vessels, 3662. Salicylic acid not used in this country, 3663–64. One case of lager beer being salicylised, 3666, 3671. Bottled beer needs no preservative, 3666-67.

Cider may be salicylised, it requires a preservative, 3665.

Salicylic acid used in wines, liquids of weak alcoholic strength desired to be clear, and imported fruit pulps, 3558. Proceedings taken for its use in lager beer and orange wine, 3559.

Formalin is dangerous, 3659, acts directly on milk curd, is a poison, and an antiseptic, 3660.

Sulphurous acid not to be classed as an antiseptic with formalin, 3672; it keeps changing into a sulphate, a natural constituent of beer, 3673, and is not dangerous, 3674.

Colouring matters might be declared, 3678.

Declaration as to preservative in milk not objected to, 3549. Difficulty in stating amount, 3550, because of insolubility of boracic acid and difficulty of exactly estimating its presence, 3551-53, 3628, and uniform diffusion, 3629, even in milk, 3630, and liable to repeated dosage, 3558. Qualitative analysis easy, 3554. Declaration would tend to limit amount used, 3556. No objection to declaration of copper in peas, 3592, 3594, 3596. Fact is stated in Pennsylvania, 3595. No objection to amount of copper being stated, 3597. Declaration of preservatives generally not objected to, 3677.

Prohibition of preservatives would seriously interfere with trade, especially dairy trade, and provision trade generally, 3675-76.

Bell, Dr. Robert. (Digest of his evidence.)

Doctor of Medicine, Member of the Royal College of Surgeons, Edinburgh, Fellow of the Faculty of Physicians and Surgeons, Glasgow, 2781-82.

Borax and boracic acid studied as used in medicine and surgery, 2783-84, and these only, 2795. Boracic acid a saturated solution of 1 in 30, 2827-28.

Physiological effects of boracic acid used medicinally in moderate doses beneficial, 2786. Extreme case of saving of life by its use, 30 grains daily, 2787, 2789. Borax constantly sucked for years without ill effect. Boracised milk long taken without ill effect, 2787. No ill effects would follow consumption of boracic compounds by the community unknowingly, 2788. Forty grains per diem not dangerous, 2790, nor 50 grains, 2811, nor 90 grains daily, 2791, 2824-25. In a surgical case several lbs. used on a raw surface without ill effect, 2793. There would be great absorption into the system, 2794. In his experience no ill effects have followed absorption, 2796. Boracic acid largely used by most eminent surgeons, especially for washing out the bladder, 2797. Fatal results following internal washing with the acid would equally have followed the use of water, 2799. Own experience preferred to that recorded by others, 2800-2. Boracic acid has no cumulative effect, 2826. No ill effects from its use known, 2834, but opinions differ, 2835, and prejudice is at the bottom of adverse opinion, 2836.

Dose reduced by "Pharmacopœia," reason not known, 2803, nor fact; doses therein not followed because empirical, 2804. Ten grains suffice to produce a medicinal effect, 2805-6, that is 30 grains a day, 2807. Boracic acid may be administered in all conditions, 2808, in nephritis, 2809-10. Fifty grains an absurd and unnecessary dose, 2813, to adults, 2815. Would not give a child 40 grains, 2816. That amount in milk would show meddling with the food, 2818.

Declaration of boracic acid in food not necessary, 2793, nor approved of, 2831, but objected to, 2832-33.

Prohibition of boracic acid not necessary, 2812, not even if 26 grains were added to a pint of milk, 2817. More good than harm done by the use of the acid, 2814.

Salt and saltpetre bulk for bulk more harmful than boracic acid, 2791, but these would be detectable in food, 2792. Saltpetre would spoil milk, 2819.

Milk of Glasgow Dairy Company boracised, 2787. Milk so treated better than putrid milk, and has no toxic effect, 2826. A saturated solution can be easily distributed uniformly, 2827-28. Milk difficult of manipulation without boracic acid, 2839, even when pasteurised, 2840, because germs of decomposition are arrested only, 2841; but germs of disease are killed thereby, 2842, and this a positive gain, 2843, and there is a gain in time, 2844. But decomposition takes place quickly in hot weather, 2845. Copenhagen method of milk distribution unknown, 2846. Milk should be sterilised, 2847, but a little boracic acid also put in, 2848.

Cream in jars if preservatised in its top parts, not properly treated, 2829. Preservatives not needed in cream, 2830, 2837, 2839. Cream a substance liable to change, 2838.

Bacon mild cured by 0·6 per cent. of boracic acid better for stomach than old salt cured bacon, 2821. Cure suggested by injection of boracic acid; bacon probably steeped in the acid, 2822. Details of cure not known, 2823.

Hams cured by 0·6 per cent. of boracic acid, 2823.

Bennett, Mr. J. Wheeler. (Digest of his evidence.)

Appears on behalf of the London Chamber of Commerce, 126; and represents largest curing house in British Empire, 130.

Canadian products sprinkled with about 4 ozs. of dry borax to 56 lbs. during last 20 years, after curing has been effected; product immersed in water, and borax washed off on arrival in this country; then drained and smoked, 128-30, 184-87; witness has eaten bacon thus treated for 20 years, 138; 80 per cent. of borax always lost in washing process, and all of it in winter, 140-42; no method other than by sprinkling known, 151.

Increase of Canadian bacon and ham trade enormous in last 10 years, 130; and excessive in 1892 over preceding year, by reason of notoriety, and of demand of English market, and of better prices, 233-36.

Home bacon trade small, because unpopular, 131-32; firmer and harsher in cure than Canadian products, 137; relation to imported produce very small, 161-62.

Borax not noticed in English and Irish as in Canadian bacon, 135; dry borax only used on Canadian products, 138, 143-44; use became general 20 years ago, 232; does not penetrate the meat, 140, 148, but might, if contact in boxes lengthy, and large amount used, 152-55; if used in appreciable amount it would taste the meat, 148-49; amount used in butter infinitesimal, 150.

Bacon non-absorbent in winter, 142.

Saltness of bacon to excess held in check by use of borax at proper stage of cure, 145-47; salted goods not now appreciated or eatable, 176-78.

Prohibition of borax would ruin the Canadian American, and Australian trade, as to hog products and butter 156-60 166-68; prices of hog products would go up largely, 163, 165; people would thus be deprived of these products; even Continental produce would be checked except for immediate use, 168-70; and salted meat or none at all would be the result, 175; competition by other countries would cease, 178.

Other methods of preserving produce than by borax unknown, though sought, 171; no other desired, 172.

American bacon and hams first imported some 50 years back, in a crude condition, 173; imports have increased by leaps and bounds in last 20 years, by reason of perfection of quality, 173-74.

Curing process described, 182-84.

Tainted bacon caused much loss before preservatives used, 188, even though more salt was then used, 189-90; no tainted bacon now, save by negligence, 188; former market, at a large loss, for tainted bacon, no longer exists, such meat would now be seized, 191.

Injections of borax in solution into carcase not known; meat would imbibe the taste, 192.

Butter from Australia and France washed with a solution of borax, and trade largely increased, 194-98; no rancid butter now as a result; French butter comes in wrappers soaked in a solution of borax; previously it went rank in 48, and even in 24 hours, 199; method very effective, even for Colonial butter, 202-3; exporters advised as to this method, 208, 214; butter thus dealt with not penetrated by the preservative, 204-5; borax not mixed with the butter, 200-1; no mixture of butter and preservative in France, 209; and not known to obtain in Ireland, 219-20; no stipulated conditions as to French butter, 210; heavily boraxed butter would not be rejected by witness, but its taste would lead customer to reject it, 211-13; by reason of its aroma, 216-17, 228-31; but a lot of borax would be needed to this end, 218; such a butter never seen, 215; not aware of cases of excessive weights of borax in butter leading to proceedings, 221-26.

Lard, well made, requires and receives no preservative, and will keep long, 206.

Blackwell, Mr. Thos. Francis. (Digest of his Evidence.)

Chairman of firm of Messrs. Crosse and Blackwell, 4857.

Preservatives not known to be used in preserved fruits and jams; not used by Crosse and Blackwell, 4863-64, 4871 4875, and quite unnecessary, 4865, 4872, 4918-19. None used in jam pulp, 4866-67, nor by the firm in potted meats or fish, 4868-70, nor in lemon squash nor lime-juice, 4884-85. They would be convenient in the latter, to prevent moulding, 4886, and are no doubt largely used, 4887-88.

Jam from imported pulp only as regards apricot made by Crosse and Blackwell, 4905-7, and believed to be free from preservative, 4908-9, which would flavour the pulp, 4910-13. No preservative needed in any pulp, 4914-17. Preservatives do not cheapen jam, 4920-22.

Colouring of jams by cochineal extract only colouring known, 4879, in small quantity and harmless, giving uniformity of colour, 4880 83. Pickles not coloured for many years, 4885. Red earth used for essence of anchovies, 4889. Public demand a pleasing-looking article, without question of process adopted, 4891, being quite indifferent thereto, 4891-95.

Copper supposed to be used in foreign preserved peas, beans, and vegetables. Crosse and Blackwell have sold uncoloured peas; not large trade, 4876; no demand here, but large export trade, 4877. Method of adding copper to peas not known, 4896. French peas coppered abroad, 4901.

Declaration of colourings should be made: Crosse and Blackwell declare them in some cases, 4878 4898: and also of nature, 4899, and amount, 4900.

Declaration of preservatives should be made, 4874, 4897 · and nature, 4899, and amount, 4900.

Prohibition of preservatives not deemed essential if moderate quantities only used, 4873.

Analyses made for Crosse and Blackwell by a professional adviser, 4902-4.

Blaxall, Dr. Frank R. (Digest of his Evidence.)

Doctor of Medicine, Lecturer in Bacteriology, Bacteriologist to the Vaccine Department of Local Government Board, 6042-43.

Experimental work done as to preservatives in food

Précis.

6044, as to sterilisation of milk by formalin, 6045. Age of milks used in experiments not known, but deemed of recent milking, 6066, but element of uncertainty in results, herefrom, 6085. Experiments made on scientific basis, not from a commercial standpoint, 6071-73. Commercial usage of preservatives not known, 6074-76. Experiments made from May up to and during winter, 6115. All milks tested for formalin, but not all for boracic acid or salicylic acid, 6053, 6116-18, and no reason to suspect their presence, 6118-25. Bacilli in experimental milk not differentiated, 6126.

Formalin in $\frac{1}{500}$ kills all germs in milk, which latter cán be kept indefinitely, 6046-51. Method of procedure adopted, 6052-54. Thirty-eight experiments made, 6059. Control unpreservatised milks nearly all went sour in 24 hours, in hermetically sealed flasks, 6055. Sour milk preservatised had as many organisms as the control milk, but sweet milk not so, 6056. Bacteriological fermentation not seasonally different under the conditions of the experiments, 6057-58. Formalin $\frac{1}{10000}$ will keep milk sweet for a short time, 6078, possibly 24 hours at 60° F., 6079, not at 80° F., 6080-82, the 24 hours being it may be from 36 to 50 hours after milking, 6083-84. In $\frac{1}{50000}$ formalin no use for keeping milk 24 hours in summer weather, 6086-91, 6095, 6098, and would not prevent formation of lactic acid, 6099-6101, but $\frac{1}{5000}$ would keep it for 24 hours at 70° F., 6107. Specification of formaldehyde on the constituents of milk not known, 6092-93. Formalin of experiment guaranteed as a 40 per cent. solution but not tested, 6112-14. About $\frac{1}{7000}$ would kill typhoid bacilli, 6142, and $\frac{1}{500}$ any bacteriological organisms in milk, 6146, and render milk unsaleable, 6151. Formalin hardens sections, 6143-44. Organisms in milk diminish rapidly on addition of formalin, 6147-48. Volatile nature of formalin not known, 6149-50.

Boracic acid less powerful as a germicide and antiseptic than formalin, 6061, 6094, and also as a preservative, 6067-69. Boracic acid up to $\frac{1}{33}$ will not sterilise milk, 6062 ; fermentation ceases, but organisms grow freely, 6064, 6129. Milk will only take up about $\frac{1}{25}$, 6063. In $\frac{1}{200}$ milk sours in 24 hours at 80 deg. Fahr., 6064-65. In $\frac{1}{2000}$ no effect in keeping milk sweet during summer weather, 6096-98, and would not prevent formation of lactic acid, 6099-6101 ; but $\frac{1}{200}$, an undesirable amount, would keep milk sweet for 24 hours at 70 deg. Fahr., 6108. About $\frac{1}{100}$ or 5 grammes per pint will produce inhibitive action in milk, 6127-29. A proportion altogether in excess of the pharmacopœial dose requisite to keep milk sweet, 6130. Inhibitive action of boracic acid apart from milk not experimented on, 6131-32.

Salicylic acid as ineffective as boracic acid as to milk sterilisation ; milk practically saturated, $\frac{1}{400}$, not sterilised, 6070.

Sourness of milk the essential test of its injuriousness, 6102-6, but a poor test of other changes going on in milk, 6137 ; but smell distinguishes nearly all harmful lactic changes, 6138-39.

Preservatives' antiseptic power in relation to toxic equivalents not known, 6109-10, but important, 6111. Preservatives have a selective action on organisms in milk, 6133-36.

Germicidal power of preservatives different on different bacilli, 2140-42.

Blyth, Professor A. Wynter. (Digest of his Evidence.)

Public Analyst, &c., 3348-50.

Colouring of foods with aniline dyes rare years ago ; but for last eight or ten years sweetmeats and other articles coloured with coal tar colours, 3351, and these latter doubtless cheaper by reason of greater tinctorial power, 3352, and found in sweetmeats, jams, jellies, and one sample of Burgundy wine and suspected in butter, 3353, 3366. Grape juice sufficiently colours wine, 3354. Aniline colouring not found in dangerous proportion in any one article, but the accumulated effect of eating many articles so coloured might injure a child, 3358. Colourings in dairy produce not separated by witness, 3365-66.

Vegetables of bright green found to contain aniline dye, 3356. Copper found in many and in all of French origin. It is a natural constituent of vegetables, 3357, 3376. Fact disputed by a French chemist, 3387-91.

Copper found in peas, flour, bread, tobacco, and ash of lime tree, 3377. Method of detection, 3378-86, at fault, 3387-91 ; but copper held to be natural to peas, 3391 ; but fact not known apart from general acceptance and witness's own experiments, 3392-95. A certain amount of copper in peas would not be injurious, 3421 ; amount not remembered, 3422. Some 4 to 5 grains per lb. have been found in peas, 3423-25. No physiological result anticipated from 5 grains per lb. of peas, 3426-27, 3429, 3433. Solubility in gastric juice or human economy doubted, 3428. Pharmacopœial dose of sulphate of copper from $\frac{1}{2}$ to 10 grains, 3430-31. Some limitations should be fixed, 3432-33. Wrong to use a strong poison to simply colour food, 3434.

Sweetmeats of red colour nearly always coloured with rhodamine or analogous colour, 3369, not a noxious substance, 3370.

Macaroni coloured by Martius' yellow, 3358, 3362, in very small quantity, 3363. Its presence can be detected by analysis, 3364.

Wines not coloured on any scale, 3355. One sample of Burgundy found to contain colouring like fuchsine, 3413-14, quantity unknown, 3415. Liqueurs not examined, 3416.

Beers found only to be naturally coloured, 3419.

Declaration of nature and amount of colouring matter should be stated, 3435. Difficulty in determining the exact quantity of copper, 3436-37.

Prohibition of certain colours advised by Weyl in Germany, 3358. Certain colours, including picric acid, believed to be prohibited in that country, 3359. Injurious colours should be scheduled, 3360, for all produce, 3361. Not a matter of difficulty *quâ* analyses, 3371-75.

Dangerous colours held by Weyl to be picric acid, dinitrokresol, Martius' yellow, Bismarck brown, orange II., and metanil brown, 3358. Case of poisoning by dinitrokresol, 3360, recorded by Weyl, 3396-97. Harmfulness of dyes could probably be determined by long continued experiments on animals, 3398, by multiple experimenters, 3412. Colours scheduled in Belgium, 3399-3400. Fuchsine classed as poisonous, 3401, by an error of opinion, 3402-3. Some such arrangement as obtains in Belgium and Austro-Hungary would meet the case here, 3404, without difficulty, 3405. Classifications should be elastic, 3406. Power of alteration should be vested in Local Government Board or Board of Agriculture, 3407, or in a Standing Committee, 3408, both as to colourings and preservatives, 3409. Standing Committee generally agreed upon as being useful, 3410. Classification would have to be made on general principles, 3411. Salts of copper, picric acid, and impure aniline dyes occasionally used, 3417, but not within personal experience, 3418. Dinitrokresol would presumably derange a child's digestive organs even in small quantity, 3420.

Analyses often rendered difficult as to quantities by smallness of samples, 3364, 3369. Almost any aniline dye can be detected, 3367 ; the amount of dye being relatively very small, 3368.

Preservatives in common use are boracic acid, borax, salicylic acid, and formaldehyde, 3439 ; the latter a stronger antiseptic than the first, 3463.

Salicylic acid found in temperance drinks, to arrest fermentation, 3460.

Borax given for thrush, up to 20 grains a day without seeming harm, 3464-66. A child taking 160 grains a day, as is possible in milk, would be injuriously affected, 3467. Quantity to be used should be restricted, 3468. Cumulative effects disproved by Liebrich, 3469. Other recorders point to accumulation, 3470. Continued dosage tends to harm, 3471. Witness idiosyncratic to boracised cream, 3472. Medical men should know if their patients are taking boracised food, 3473.

Declaration of preservatives should be made, 3458 ; and would serve as a safeguard against their repeated use, 3459. Preferable to labelling, 3474-75.

Milk often dosed with boracic compounds in summer ; seldom in winter ; but one sample found in December to contain 80 grains of borax per pint, 3439, 3442. But skim and fresh milks may have been in question, 3444, both boracised, 3445-46. Case rare, but found at times in summer, 3440. When added not known, 3441. Boracised milk often watered, 3442, probably owing to mode of admixture of preservatives, 3443. Preservatising of milk not approved of, but London trade demands it, 3447, as now organised, 3448, 3476-77, as does that of other large towns, 3478-79. The matter one of rapid transit, 3480-81. Boracising of milk many years in vogue, 3454, but not found in country milk twenty years ago, 3455. Much London milk not treated now, 3456, but retail dealers in poorer parts create a difficulty, 3457. Milk should be available free from preservatives, 3458.

Pasteurisation possibly a question of organisation, 3449-50. Would doubtless increase price, 3451. If in force in Copenhagen, that a small place compared with London, 3452-53.

Bond, Mr. Thomas. (Digest of his Evidence.)

Consulting Surgeon to Westminster Hospital, &c., 3062.

Boracic acid studied as to effects on the human consumer, 3063. Given to hundreds of patients in 10 grain doses, 3064. Given in bladder diseases for months together; no ill effects, 3065. Usual dose 30 grains per diem, 3066. Would like to know if patients were otherwise taking the drug, 3067, but not necessary to know it, 3068-69. But a medical man ought to know of any drug being taken that would modify his treatment of a patient, 3094. Physician should know if milk is boracised in cases of albuminuria, 3164-66. Gives grain doses for children in diarrhœa, 3071, 3073. Children do not have bladder disease, 3072, but the drug not unsuitable to children, 3073. Has had a few cases of itching of skin following use of boracic acid, 3074, in old men with dropsy and renal disease, 3083. Kidney disease contra-indicates large doses, 3084, 3098. Putridity of urine treated with boracic acid, 3085-86. Thirty grain doses daily would create a pronounced skin itching and perhaps some eruption, 3087. External use has led to no ill results. Case of a child sitting daily for months in a saturated solution without harm, 3097. Retards decomposition of food in the stomach; bad for irritable stomach, 3135-37, 3140, 3142, and contra-indicated therefor, 3141. But contra-indications not widely prevalent, 3144-46, 3148-54. Mortality from kidney disease not known, 3147; nor case fatality rate, 3150. Indiscriminate use of boracic acid might possibly hasten fatal termination of kidney disease, 3155. Contra-indicating conditions of indigestion widely distributed, 3156. Contra-indication in pregnancy not known, 3157-61, but not disbelieved, 3162. All cases of renal disease do not contra-indicate the acid, 3163.

Dose of boracic acid for a child one-fifth of an adult dose, 3076-78. Forty grains a day a limit for an adult, 3079. From 2 to 3 grains a dose for a child of five years, 3080. More would not be dangerous, 3081. Danger limit unknown, 3082.

Experiments of Dr. Annett on boracised kittens of little worth *quâ* human analogy, 3103-4.

Salicylic acid given in 10 grain doses without ill result, 3105-6; given in bladder diseases, 3107. Usual dose 30 grains a day, 3130-31. Contra-indicated in kidney disease, 3108. Delirium not known to have been produced by salicylic acid, 3107, 3110-11. Not known to be given for indigestion, 3143.

Formic aldehyde used in bladder diseases in 10 grain doses thrice daily, 3123; as a preparation called urotropine, a preparation of formic acid and ammonia; not in "Pharmacopœia," 3125-26, 3134. The chemical procedure unknown, 3127. Relation of formic acid to formalin not known, 3124. Formic acid said to be an antiseptic, 3128-29. Has not used it, 3132. Only experience is of the urotropine, 3133.

Declaration of preservatives would be a proper course, 3075, 3167, and of nature and amount of boracic acid, 3095-96, 3101, 3142, and of salicylic acid, 3109.

Quantity in use of boracic acid should be controlled; but quantities used as preservative quite harmless, 3088. About 5 grains per pint of milk quite safe, 3089; but a child might thus take too large a dose, 3090-93. Twenty-six grains per pint of milk quite unusual and unnecessary, 3099, but nothing to prevent it, 3100, and milk is liable to repeated dosage, 3102. Indiscriminate use of boracic and salicylic acids not advocated, 3112. Two grains of latter in a pound of jam harmless, 3113-14, but an efficient preservative, 3114. A pound of such jam more harmful than the contained acid, 3115. Ten grains in a quart of wine harmless; so also 10 grains in a pint, 3116; same in a bottle of cider, 3117, and in a quart of beer, 3118. Thirty grains consumed with alcohol would do less harm than the alcohol, 3119-22.

Colouring matters not studied, 3138-39.

Boseley, Mr. Leonard Kidgell. (Digest of his Evidence.)

Analyst to Messrs. Keiller and Son, 948. Appointed primarily to determine amounts of sugar needed in jams to prevent fermentation and crystallisation, 1010. Trained by Mr. Otto Hehner, and formerly second chemist to Aylesbury Dairy Company, 971.

Dairy products (milk, cream, butter, and condensed milk) most frequently treated with borax, boracic acid, and formalin, very occasionally with salicylic acid, nitrates, and sulphites, 951-52.

Formalin is a 40 per cent. solution of formaldehyde, 952.

Milk not universally preservatised in London, but perhaps 50 per cent. is, 956. None sold by Aylesbury Dairy Company is preservatised, 1017, at any season, 1019.

Milk 10 to 12 hours old when distributed, 1022, 1024-25. Not pasteurised, 1026-27.

Use of formalin and borax equally general, 989. Has preservatised several milk samples with formalin, 990. Amounts used, one in 2000 to one in 10,000 parts; former will keep milk unchanged for months, 992, 995. The milk remains sweet, and does not curdle, 996-97. Could not testify to fitness of the milk for consumption, 1002. Cannot say as to amounts of formalin in milk, 993. It persists in milk when added, 994. Such milk would give a reaction with litmus paper, both acid and alkaline, the former if lactic acid were formed, 998-99. No samples tested for changed reaction, 1000. No physiological experiments made, 1001.

Borax added to milk in parts varying from 1 in 1000 to 1 in 10,000, 953. The latter of doubtful utility as a preservative, 954. Higher proportions were frequent, 955. Boracic acid becoming used more generally than other forms of preservatives, except in jams, preserves, and cognate articles, 986.

Butter in London preservatised to extent of 50 or 60 per cent. of amount sold. All French produce is preservatised, 957, 973-74, 976, 1013-19. Boracic acid is found in solution in the water in French factory butter, 958, and is presumably put in during churning, 959-63. No preservative in butter sold by Aylesbury Dairy Company, 975, 977-81, 1017. It comes from the Company's premises, from Wiltshire, and France, and Denmark, 1023, 1028-29; but the Company have received supplies of butter artificially preservatised, 1036-37. Has analysed rancid butters, 1003; without detecting preservatives, 1004; has made no experiments as to keeping properties of preservatised butters, 1005-8. Danish and French butters tested for preservatives, 1031; latter often contained boracic acid, 1032. Former not remembered as having yielded preservatives, 1034-35.

Cream in jugs sold by Aylesbury Dairy Company used to be preservatised; practice stopped, 981, and issue of the potted cream ceased, 1036, because of action by analysts, 1017. No preservative in their clotted cream, 982-83. Preservatives required if clotted cream is needed to keep more than two days in summer, 984. Aylesbury Dairy Company's cream partly from Wiltshire, mostly made on Company's premises, 1038. Cream sold by a large company needs no preservative, but that by small vendors does to make sale pay, 1039.

Jam makers, to extent of 50 per cent., use preservatives. Chiefly salicylic acid, ½ oz. to 1 cwt. of jam, or one part in 3500. Benzoic acid sometimes used, and benzoate of soda now used by one London firm, 968. No preservatives used in fruit before jam is made, 969-70; not at all by Messrs. Keiller, 1143. They would like to use them, 1,144. Messrs. Keiller's jams, except apricot from pulp, made from fresh fruit, 1009. In jam making in large quantity, under present methods, preservatives needed to keep jam several months, unless the jam be cooked to stiffness, 1084-85. Appearance is everything in jam, and cooking a short time by steam enables the appearance to be maintained, 1086. The salicylic acid is boiled with the jam, 1087. It is intimately mixed, 1088, 1092. About 5 milligrammes in 1 lb. of jam, 1089-91. Salicylic acid used of necessity in jam pulps, 1092. No instance of jam or pulp salicylised going wrong, 1093-95. Best beetroot sugar used in Messrs. Keiller's jams, 1159-60. Sugar most effective when boiled with the fruit, 1161-65.

Salicylic acid is the jam-makers' preservative, a good anti-fermentative, 986-88.

Raspberries known to have been sprayed with formaldehyde, 970.

Preservatives not deemed necessary by Aylesbury Dairy Company, 1018; all the year round, 1019. Company supplied from distances such as Wiltshire and Cheshire, 1020-21. Not used for Messrs. Keiller's bottled fruits, which are sterilised, 1062; nor for their jams, 1143.

Sodium fluoride not a good anti-fermentative, 1046.

Deleterious action of preservatives not known, 1047-48.

Bacon and hams, treatment with preservatives only known on hearsay evidence, 1040-43. Has never determined the amount of boracic acid present, 1044.

Colouring matters in confectionery and jams, complete list of, and quantities used, possessed, 1049. List handed in, 1064-70 (App. No. 18). Reference given to experiments as to effect of colouring agents on digestion, 1071-73. No metallic colouring matters used by Messrs. Keiller. Colours used practically free from arsenic and lead, 1074. In dairying, chiefly annatto used, an extract from the plant *Bixa orellana*. In milk, in aqueous solution, one part in 300,000; in butter, in a solution of cotton-seed oil, 1050; thus used, quite insufficient to flavour milk,1051. Red pickled cabbage coloured with 4 ozs. of sulphuric acid to a 40-gallon barrel. Piccalilli has 3 lbs. of turmeric to a 40-gallon barrel, 1056-60. Has never analysed annatto, 1078-79. Bottled fruits sold by Messrs. Keiller not coloured. In jams of dark colour, magenta or fuchsine (an acetate of rosaniline or a hydrochlorate of rosaniline) usually added in one part in 100,000, occasionally one in 75,000; vermilion usually added in one part in 80,000. These the only colours generally used, 1063, 1148-51. Health of workers not affected by the magenta, 1074, 1145-47, 1164. Composition not known or tested, 1152-58. Apricot and yellow jams and marmalade seldom coloured, 1063.

Colouring not requisite in jams, 1080; but improves their appearance, 1081. None used by Messrs. Keiller, 1142-43.

Annatto, alone, used by Aylesbury Dairy Company, 1097, 1102-4; and dissolved in cotton seed oil in butter, 1101. Aniline dyes becoming more general in milk, 1098-1100.

Martius' yellow rarely used for colouring, 1112-14; it is a poison, 1115; has never known it in butter, 1116. Imitation Demerara sugar from beetroot occasionally treated with aniline dyes, 1117. Use of iron salts and colouring of peas with copper not subjects on which he has any wide knowledge, 1107-11, 1118-27. Zinc compounds believed to be added to peas, 1128-29. Oxide of iron found in cocoa, 1130-37. May have been added as an ochre 1138. Hofman's violet used for sweets 1139-40.

BOYCE, PROFESSOR RUPERT. (Digest of his Evidence.)

Professor of Pathology, University College, Liverpool, and a Public Analyst of Liverpool, 2706-8, 2758, for bacteriological purposes, 2759-63.

Prosecution successful in a case of formaldehysed milk, 2709-10.

Preservatives found to be used, formaldehyde and boracic acid, 2711.

Experiments upon young kittens important; on dogs or guinea-pigs almost worthless, 2713. Kitten's digestion resembles the human, as does also its food, 2714. Cats are carnivorous, 2715. Infant's food approximates to the kitten's, 2716. Sucking pigs good for experiments; but cats and dogs most commonly used, in preference to rabbits or guinea-pigs, 2717. But certain rodents are susceptible to diseases affecting the human to which cats and dogs are not susceptible, 2718. Tuberculosis at times affects cats and dogs, 2719. Formalised milk not so appetising as undoctored milk to kittens, 2720; the same true of boracised milk, 2721, 2727-28. Kittens doubtless tend to lose their appetite for boracised milk diet, 2722. Animals used for experiments by Rideal and Foulerton too old, 2726. Continued dosage with preservatised milk tends to immunity of kittens; natural immunity also comes on about three months of age, 2731. No experiments made as to bacterial growth in preservatised milk, 2747 48. Bacteria grow rapidly in milk, 2749. Bacillus coli and enteritidis sporogenes present numerously in seemingly sweet milk; formalin and boracic acid would scarcely inhibit their growth, 2750. Continued experiments on kittens yielding results like those of Dr. Annett should suffice to prohibit preservatives in milk, 2777-80.

Injury of formalised milk inferred, 2724; even in small proportion, 2725. Demonstrated as regards formalin and boracic acid in respect of infants, 2732. Inference from Chittenden's experiments on dogs in normal health that harm to adults would not accrue, 2733-34. Immunity as the result of repeated doses an argument against preservatives, 2735; because of expense at which gained, 2736. Medical men and patients handicapped by unconsciously-secured immunity to boracic acid, 2737-38. Continued dosage would be harmful, 2776. Formalin is a great irritant, even in small proportion; its action is inhibitory; it lowers the cell vitality, and has direct action on enzymes, and affects digestion through the agency of food, 2751-52, 2754-57. Boracic acid not found to irritate witness, 2752. Ammonia in certain quantities an irritant, 2753. The vapour of osmic acid also irritates, 2756. Non-irritation of formalin at a manufactory would speak well for the modern methods employed, 2771.

Declaration of all preservatives in milk not impracticable, 2764-66, 2769, and would solve many difficulties, 2767, with no great onus on a local authority, 2768. The components of the mixture should be declared, 2770, if not prohibited, 2773, 2776. Increased use of formalin would render milk unsaleable, 2774. Non-limitation of amount of boracic acid would be a difficulty, 2775.

Prohibition preferred to declaration, 2772.

Continental use of preservatives inquired about, 2729, 2739. Experiments found to be meagre, 2730, 2740, 2741 (footnote), but feeding experiments with boracic acid in milk proceeding in Berlin, 2730. Preservatives prohibited in Belgium and in Germany, 2741. No evidence of enforcement of law, 2742. Preservatives found to be used in imported American meat, 2743. Preservatives believed to be prohibited in Austria, 2745. Switzerland not visited, 2746.

BRIERLEY, MR. JAMES. (Digest of his Evidence.)

Public Analyst for Southampton Borough, &c., 3168.

Preservatives in food studied, 3169, and found only in milk, wine, and beer; formalin and boracic acid preparations only found save in wine, 3170. Many other foods examined, 3171, but not bacon, 3172. Use of preservatives increasing, especially in last ten years, 3173, 3207-9. Both formalin and boracic acid increasingly used, 3210, in equal amount, 3211. Preservatives not much used prior to Food and Drugs Act, 3274. Used now owing to larger demand of increased population, 3275. No relation, except in time, between the Food and Drugs Act and commencing use of preservatives, 3276-77.

Boracic acid sold largely by chemists for use in milk without instructions as to use, 3214. A good remedy for thrush, 3245. Pharmacopœial dose not known, 3246. For young children 4½ grains per pint of milk, undiluted, not safe, 3247, 3250-51. Poor children not likely to get 4½ grains a day, 3248-49.

Formalin only should be permitted in milk. Only a small quantity is used, large doses would make the milk smell unpleasantly, 3182. Added regularly by one wholesale dealer, but only in summer, 3188. Preferred to boracic acid, 3215. Potency not known, 3216. Action inside the body not known, 3217, but not admitted as being same as outside, 3223-28. Formaldehyde, raw, has a hardening effect, like alcohol, on certain tissues, 3220. In quantity used 0·012 per cent., hardening effect must be infinitesimal, 3221. His family had used formalised milk for two years without injurious effect, 3229, 3255. Use outside milk not known, 3230. Hardening effect on fish not known, 3231. Hardening effect stated on foodstuffs would, if appreciable, affect their digestibility, 3232-35.

Experiments limited to a few persons, vitiated by idiosyncrasy, 3218. Dr. Rideal quoted as showing less interference with digestion by formalin than by boracic acid or alcohol, 3219. Milk supplies of institutions should be watched and analysed for preservatives, and notes taken as to health of children supplied with the milk, 3252.

Declaration of amount of preservative fraught with difficulty by reason of ofttimes repeated dosage of milk in different hands 3183-84. But declaration by first handler would be a check on quantity, 3185. Repeated dosage a disinterested action, 3186, and an added expense, 3187.

Prohibition of preservatives in milk would throw much milk on dealers' hands as useless, 3179, but this is a question of organisation, 3180.

Milk outside Southampton preservatised by dissolved preparation, 100 grains to a gallon, over 12 grains per pint, 3174; in summer only, 3177. Thirty-five grains per gallon of boracic acid alone, or mixed with borax sufficient, 3175. Keeping of milk depends on home and other conditions of storage, 3176. Preservatised milk goes bad rather than sour, 3178, 3254-55. Such milk may at times be refrigerated, but is not pasteurised, 3181. Some farmers, and many large wholesale dealers, habitually preservatise milk in Hants, 3188. Larger amounts added than vendors declare necessary, 3212-13. Milk samples, 118, examined in the year, and almost all would be formalised or boracised in summer. These drugs not sought in the summer months, 3236-38. Imported milk contains much larger quantity of formalin than English milk, 3239, as judged by comparative results, not by actual determination, 3240. Sample taken at the Docks, 3241, 3273. Only three samples taken, 3242-43. Quantity coming in not known, 3268-69, 3272. It was from Cherbourg or Havre, 3270-71. Lactic changes in milk retarded, and others not retarded, by added preservatives, 3253, and these latter equally detrimental, 3254. Milk need not of necessity be preservatised; but it should keep 60 hours, 3256; demanding more preservative, if such be used, than would keep it for 24 hours, 3257. If practicable, a time limit of only 24 hours' keeping preferable, 3258. Delivery of milk more frequent prior to use of preservatives, 3262. Many farmers then did not supply towns with milk as such. Milk supply more copious now, 3263. Cheap milk now may mean milk and water, 3264. No greater difficulty in getting milk than formerly in enlarged Southampton, 3265. More copious milk supply as being due to use of preservatives not known, 3266-67. Now that preservatives are used, milk formerly made into butter comes to town as milk, 3278.

Cream not examined for preservatives, 3244.

Butter need not be preservatised if properly made, 3189, and butter-milk expressed, 3190.

Bacon not examined, 3172, 3197-98, not an "article of food," 3199, under terms of Food and Drugs Act, 3200, and cases of proceedings not known, 3201-6.

Wine, sherry, had salicylic acid added, 3191, sufficient to vitiate compliance with "Pharmacopœia" requirements, 3192. Was a high-class wine, 3193. Sample came from London, 3194, in cask, 3195. Submitted for pharmaceutical purposes, 4 ozs. only, 3196. Preservatives not necessary in wine, 3259-60. Used only since Food and Drugs Act passed, 3261.

Colouring matter, behaving like methyl orange, commonly used for low class butters and margarine, 3279. Margarine made thus to imitate butter, 3280, and inferior butter to imitate good butter, 3281. Milk not known to be coloured in Southampton. Annatto freely used years ago, 3282. No knowledge of bad results following its use, 3283. Annatto simplest colouring agent, 3284. Used in butter as well as milk, 3285-86. Saffron also known to have been used in butter, 3292. Certain coal tar derivatives should be prohibited, 3290. Arsenic said to have been contained in them, 3290-91. Not much known of them by witness, 3293-94.

Copper in peas led to prosecutions in Southampton years back, 3287. No ill results known from eating coppered peas, 3288, or other vegetables, 3289.

Brunton, Sir Lauder. (Digest of his Evidence.)

M.D., F.R.S., and nominee of Royal College of Physicians, 7423-24.

Chemical preservatives in food studied, 7425-26. Use should be regulated, because of double danger of undue use, 7427. They may enable cleanliness in milk trade to be dispensed with, 7430. Relative value and harmfulness of preservatives need to be accurately ascertained, 7431, over a length of time as to result of their continued use, 7432-36. Many of the preservatives may be as harmless as chicory in small quantity, but not in excessive quantity, 7442.

Contra-indication of borax in pregnancy, 7463, and indiscriminate use of salicylic acid should not be permitted, 7464.

Cumulative properties of preservatives—such as boracic acid—elements of uncertainty, 7434-36.

Declaration of salicylic acid a matter of importance to patients taking it as a drug, 7464. Amount should be stated, as also as to colouring agents, 7470.

Court of Reference advocated, with specific declaration of preservatives as a basis of action as to legalisation of such preservatives, 7437-38. Medical profession should be well represented on such a Board, especially the Royal College of Physicians, 7439. Board originally suggested by analysts, 7440, and analysts requisite to its constitution, 7441. Such a Board would result in the formulation of definite rules as to preservatives, 7443. Our present knowledge as to milk trade without preservatives, a case in point of present defective information, 7444, as also in regard to sterilisation of milk, 7445. Matter of preservatives an important one to medical profession, 7456-57. Practice of physician might be stultified by their use, 7456-62. Present Committee hardly in a position to give a pronouncement as to preservatives, 7466. The Board suggested might lead to the prohibition of preservatives, 7467.

Milk can be supplied to large towns unpreservatised, 7428, and should be, 7429. Cooling and sterilising would obviate need for preservatives probably, 7444. Cooling the best known form of preserving milk, 7449-51. No bad results known or feared from refrigerated milk, 7452-55. Milk supply to all hospitals should be examined for preservatives, 7465.

Sterilised milk held by some to be injurious, not so held by witness, 7445, but our knowledge may be defective, 7446-47, the raising of milk for a short time to 180° F. being in question, 7448.

Copper in minute doses quite innocuous, 7468, but it should be specifically declared, 7469. Unequal distribution in peas should hold manufacturer liable if fixed amount for whole be exceeded in any one portion, 7471-72.

Cameron, Mr. Henry Charles. (Digest of his evidence.)

Produce Commissioner to the New Zealand Government, 6152.

New Zealand butter output increasing, 6155, 6214-15, and quality steadily improving, 6156, owing to instruction and inspection, 6157. Still room for improvement in New Zealand butter, 6303, and measures are taken accordingly, 6304. Butter made at dairy factories and graded by Government inspectors, 6159-60. "Factory" butter as known at home is "milled" butter of second grade in New Zealand, 6161-62. Best butter exported with salt and in many cases Preservitas, 6163-64, principally boracic acid, 6165. A little has been sent absolutely fresh, but bulk with salt, 6166, and a good deal is preservatised, 6167. Milk sent to dairy factories distance of some four miles twice a day, 6185. Butter comes to England from December to May or June, 6216. Trade small in comparison with Colonial trade generally, 6228-33. Retail trade in New Zealand same as export, 6247. Butter reaches consumer in England in eleven weeks from manufacture, 6248-49. Complaints of butter have been made but kind of butter not known, 6250-51.

Margarine not exported from New Zealand, 6226, nor made there, 6227.

Price of New Zealand butter cheaper than Danish butter 6168, and butter coming over unpreservatised sold cheaper than preservatised butter, 6207-10.

Freezing affects butter, 6168. All New Zealand butter comes frozen, 6169, and defrosting tends to depreciation of the butter if not preservatised, 6171, 6202, 6295-97.

Salt added to New Zealand butter to suit taste of consumer, 6170.

Preservatives added to New Zealand butter to aid keeping after defrosting, 6171; but not universal, 6172, on account of recent action over here. Finest butter is preservatised slightly, 6173. Preservative very exactly blended with butter, 6184. Not likely to be added to milk by farmers because unnecessary, 6186-96. Preservatives facilitate New Zealand butter trade, 6203, essential to keeping the butter in the finest condition, 6204, but the trade not absolutely dependent on their use, 6205, though without them quality and price would decline, 6206. One-half per cent. of preservatives for butter quite enough, 6234-40, and satisfaction would be felt at any limit laid down, 6241-42. New Zealand Government have legislated as to preservatives, reserving the right to prohibit them if need be, 6246.

Experiment made by New Zealand Government to determine results of adding preservatives to butter, 6174; and ½ per cent. of preservative found beneficial for keeping butter, 3 per cent. of salt being also added, 6175-81, 6274, and preservative being boracic acid and borax, 6182, for ease of application, 6183, in powdered form, 6184. Evidence in a report of Mr. Sorensen, when Chief Commissioner of New Zealand Department of Agriculture, against use of preservatives in butter, 6252-69. Only one churning used for the experiment, 6270-73. Further experiments have been made, 6275-78. 6308-9. Conditions of uncleanliness obtain still in New Zealand dairy farms, but these not held to vitiate the results of the above experiment, 6279-89.

Standardising of fresh preservatives advocated, 6242.

Pasteurisation in New Zealand used to slight extent, 6179, with rather unfavourable result, 6198, 6200, by removing the finer taints, 6199, necessitating a ferment, 6200. Quality of pasteurised butter not quite as good as ordinary butter, 6201, 6294-6300, and quality goes off after defrosting, 6202. With perfect milk pasteurisation not needed, 6301-2. Pasteurisation brings up the average of butter, 6305-7.

Declaration of butter as preservatised not objected to, but country of origin might suffice, 6211-13, 6243-46.

Cooling of milk compulsory in New Zealand, but not enforced according to Mr. Sorensen, 6290-93.

Colouring matter not needed nor used for New Zealand butter, 6217-22. Cheese is coloured, 6222, by annatto, 6223, exclusively, 6224-25.

Cameron, Dr. James Spottiswoode. (Digest of his Evidence.)

Medical Officer of Health of Leeds, represents the British Medical Association, past President of the Yorkshire branch of that Association, and of the Society of Medical Officers of Health, 2523-25. Has been in practice, 2526.

Borax and boracic acid noticed as frequently in use in foods, especially milk and butter, 2527. Boric compounds sold freely, but not in large domestic use. Glacialine sold in sixpenny boxes, 2531. Public not generally aware of use of preservatives, 2532. Boracic acid and glacialine only boric compounds known in Leeds, 2537-38.

Salicylic acid used medicinally, acts powerfully on liver, is a depressant, usually taken in form of salicylate of soda; in large doses produces weakness and sickness, sometimes causes poisonous symptoms, 2546.

Formaldehyde not known of as a preservative, 2558.e

Physiological effect of preservatives is to interfer with digestive processes, 2533, 2563-69. Boracic acid given to infants for thrush, 2534. Indiscriminate use in food dangerous, especially as regards infants and invalids, for whom a medical man might want to use it, 2535. Infants might take a full dose in milk, 2536. Antiseptics have some selective action on bacteria, 2564-72. Poorer classes may suffer from boracic acid without seeking medical aid, 2583-84.

Declaration of preservatives should be made, 2557, would be useful as to coppered foods, 2578. Labelling of milk as to quantity of boracic acid would be difficult, 2580. Simple declaration would be useful to medical men, 2581, and lessen the sale of boracised milk, 2582. Colourings in food should be declared, 2587, save as to cheese, 2588-91.

Prohibition of salicylic acid should be entire, as a food preservative, 2546-47, also copper as a colouring, 2557; and of boracic acid to be preferred to declaration, 2579. Colouring in milk should be prohibited, 2592, but not in butter, 2594-95.

Milk samples taken in Leeds contained boric compounds in very varying percentages of total samples, 2528 Maximum found in milk 20 grains per gallon, 2529, five grains per quart approximately, 2530. Boracising of milk not necessary, 2579. Attitude of medical profession towards boracised milk will depend on finding of the Committee, 2583.

Condensed milk samples found to contain boric compounds, 2528.

Diarrhœa increasingly prevalent in Leeds, despite measures of precaution adopted, 2539, 2586. Some suspicion attaches to boracised milk, 2539, 2573, but no investigation made, 2577, 2585. There is a children's hospital at Leeds. Precautions as to milk not known. But stringent clause as to fever hospital milk. No boracic acid found in it, 2540-44. Diarrhœa most prevalent in autumn, 2574, when preservatives are most used in milk, 2575, going chiefly to poorer classes, 2576.

Butter samples found to contain boric compounds, 2528.

Port found to contain boric compound, 2528.

Copper frequently found in peas, 2527. Copper a poison, 2533, 2553; to some extent cumulative, 2554, 2600; but not quite like lead, 2556. Experiments made lead to inference that the digestive system may dissolve the copper in preserved peas, 2549-50; results conflict with Professor Fraser's evidence, 2551. Copper held in peas as an organic salt of copper, 2552. Copper a slow poison, with probably delayed results never definitely traced, analogous to plumbo-solvent water poisoning 2553. No cases of copper poisoning under observation, 2556. Copper as a colouring should be prohibited, 2557. Peas would naturally remain in alimentary canal some 24 hours, 2559, during which digestion would be progressing, 2560, and absorption of copper would go on, 2561. Food remains in the stomach some two or three hours, 2562. Would not habitually eat coppered peas, 2596-98, and would warn patients against them, 2599.

Cassal, Major Charles Edward. (Digest of his Evidence.)

Public Analyst, Fellow of the Institute of Chemistry, &c., &c., &c., 3783-86.

Public Analysts should be placed in a position wherein they can speak on the authority of Governmental decisions, on the question of the relation to health of added preservatives and colouring matters in food, 3788. Poisons and drugs not defined by statute in relation to foods, 3789-94. The law as it stands presents practical difficulties as to preservatives and colouring matter in the public interests, which latter are the reason for the Sale of Food and Drugs Act, 3794.

Milk supply of London needs no preservative, 3803. Cold treatment suffices, 3804. And drugs should not be permitted for the relief of the small vendor who is an undesirable milk seller, 3805. Milk should be sold in a pure and satisfactory condition or its sale relinquished, 3806. Cold storage necessary, 3807, in very hot weather, 3862, and possible with small traders, 3808. More adulteration of milk in poor districts, 3809-12. Milk of London hospitals found to be boracised, 3821. Cold treatment immediately after milking would suffice under all ordinary circumstances, 3862. All farms should have a proper water supply, 3863-64.

Cream needs no preservative, 3804, 3819. Highest amount of boracic acid found was 0·291 per cent. of boron-trioxide per lb., 3817, and lowest, 0·104 per cent. per lb., 3818. Medical men now prescribe cream in place of cod liver oil, &c., and hold use of preservatives to be a dangerous practice, 3820. In a case of boracised cream before the courts 0·464 per cent. of crystallised boracic acid present, 3852, fine inflicted, and notice of appeal given, 3853-54.

Butters examined, but origin not known, 3814. Heavy percentages of butter found to contain boracic acid, 3850-51.

Preservatives in widespread use for keeping foods saleable, and for palming off stale, inferior, and even bad articles, 3802. Substances chiefly used in milk are drugs, and are boracic acid, borax mixtures, or solutions, salicylic acid, formaldehyde; in some cases benzoic acid, probably as benzoate of soda, and boro-fluoride. All are foreign ingredients, and are liable to be added in needless quantity, 3812. Preservative chemicals unnecessary in food, 3813, and objectionable, 3816.

Boracic acid in milk held by witness to constitute adulteration, but not so held by Local Government Board. Boracic acid equal to 59 grains of boron-trioxide and 101 grains of crystallised boracic acid found per gallon of milk, 3816, 3865. Boracic acid found in a variety of articles, 3816. Smallest quantity determined in milk was equal to 19 grains per gallon of crystallised boracic acid, 3817. Boracic acid often found in mixtures of margarine and butter and in margarine alone, 3852. No difficulty now in estimating amount of boracic acid in milk, 3866, by a process of blank experiments, 3870-71.

Salicylic acid found in a variety of articles, 3816. Found in wines, in port wine in varying quantities up to 3·15 grains per gallon, 3822. It is a foreign ingredient, 3823-24. In sherry 1·6 grain per gallon found. Large amounts found in so-called British wines, 3824. An amount like 0·7 grain would have little preservative effect on port; would probably be present as the result of blending, 3825. Cheaper wines most preservatised. Has found 26·6 grains per gallon in orange wine, 11·55 grains in British sherry, 4 grains in black currant wine. Prosecution, that failed, in case of orange wine, 3826. Found in beer occasionally; 7 grains per gallon in bottled beer, 4·76 grains in Pilsener beer, 3827. Not many samples of beer examined, 3828. In lime juice 70 grains per gallon found, 3829. Some lime juice found free from it, 3830, and unnecessity hence inferred, 3831.

Formaldehyde found in milk, skim milk, and separated milk, 3816. Formalin a 40 per cent. solution of formaldehyde, a dangerous substance even in small amount, injuriously affecting digestion and having very hardening properties as shown by experiments, 3831-32. Negative evidence not of much worth in face of positive evidence, 3833. Strength of $\frac{1}{10000}$ used in experiments, 3834. Such proportion recommended for food four years ago, 3835-36. Quantitative determination not yet possible to witness, 3837, 3866, but $\frac{1}{50000}$ might be determined by colour process, 3867-69. Objects to use of $\frac{1}{50000}$ formalin in milk, but not aware that milk with $\frac{1}{10000}$ formic aldehyde is undrinkable by reason of taste; holds the contrary view, 3875-77 and footnote.

Benzoic acid found in wines, 3816.

Digestive properties of food must be injuriously affected by effective preservative drugs, 3813, 3872; and by any amount of formaldehyde sufficient to preserve milk, 3873-74.

Experiments in and outside human body not on same plane, 3872.

Poisonous substance or one having active character as a drug should not be used in food, 3794.

Declaration of composition of an article should be made, 3794; and compulsorily demanded if preservatives deemed necessary to cheapness of commodities, 3802; and should include nature and amount, 3858, and their probable effect, 3859-61; but less desired than prohibition, 3875. Practical difficulties in way of amounts being stated, 3878, and in precise determination of these amounts analytically, 3879-81, especially if a limiting value were insisted on, 3882-85, as to boracic acid, 3886, and more so as to formalin, 3887-98.

Prohibition of preservatives advocated, 3815; other than common salt, 3855, including saltpetre in the prohibition, 3856-57.

Refrigeration and sterilisation proper methods of food preservation, though perhaps more expensive, 3816.

Proceedings ending in convictions have been taken in a number of instances, 3795; but necessity of proving injury to health is a difficulty, 3796. Prejudice of customer not now found to be a difficulty as to proof, 3797-99. Expense of procedure is a difficulty with certain local authorities, 3800-1. Certain multiple forms of statement in regard of contained preservative held to be necessary to satisfy the court, 3817.

Colouring matters present difficulties; some are unobjectionable, as for butter; others, as for margarine, are fraudulent, 3838-41; as also for milk, though not for cheese, 3842-43. Aniline dye used for milk. Sugar at times fraudulently coloured, 3844, 3850; charcoal used for sweets. Various dyes from sugar and sweets used on silks, and shown to Committee, 3847, aniline dyes being in question. Dying test to silk often required to detect colourings, 3848 Nothing but caramel should be present in sugar, 3849, and it does not dye, 3850.

Prohibition of injurious colouring matters should be absolute, *e.g.*, sulphate of copper in vegetables, ferruginous earthy matters, oxide of iron and inferior aniline dyes in sweets, 3844-46. Copper sulphate a known poison, 3846. In one sample of sweets 0·34 per cent. of oxide of iron found, 3847.

Clement, Mr. Thomas. (Digest of his Evidence.)

Represents the Scottish Provision Trade Association, 1500, relative to dairy produce, 1502. Has 15 years' experience of the provision trade, 1501.

Butter requires the use of preservatives, especiall Australasian butter, 1503-5; latter known as "Colonial butter," 1506. Butter as a rule consumed within a month of leaving the refrigerator, 1544-45. But sometimes kept over for months, 1546.

Boracic acid advised in Canadian butter, 1506, 1552-53; it is not universally used, 1507; one per cent. of preservative, that is one-half per cent. of the acid, ample to keep butter, 1518. Has a distinct flavour in butter, 1519. Prohibition would seriously affect the butter trade. Used in Australasian butters, 1527-28. Components believed to be borax and boracic acid, 1529. Manufacturers guarantee 1 per cent. as containing one-half per cent. of boracic acid, 1530; would be surprised to learn that the preservative consisted of eight-tenths of boracic acid, 1531. Presence in butter detected by taste, 1532-34, even one-quarter per cent. if the butter not keeping, 1535. One-half per cent. of preservative the average in Colonial butter, 1536. Presence not always detectable, 1537-39. One per cent. detectable, 1540. Rancidity of butter would kill the flavour of the acid, 1541-42, but could not be veiled by it, 1543.

Salted butter would not be tolerated. Margarine would replace it if insisted on, 1520. Big difference between salt and fresh butter, 1556.

Canadian butter, refrigerated, does not stand the counter as well as Colonial preservatised butter, 1508-10.

Irish butter has greatly improved of late; with less moisture it would surpass Danish butter, 1510.

Danish butter has deteriorated, 1510, especially in flavour and texture, 1511, but is drier than Irish, 1512. Commands best price, 1513, and claims to have no preservative, 1514. Has lost its keeping qualities, 1516, by reason of pasteurisation, 1517.

Argentine butter, some fine, some not, 1515. Contains preservatives, 1516.

Margarine sometimes contains preservatives, 1522, but not in winter, 1523-24, only in summer, 1525.

Fresh butter for immediate use, not preservatised, 1526. Fresh butter is unsalted butter in the trade, 1560-71, 1573-79, 1581-82. It may be many months old if preservatised, 1572. It is not fresh-made necessarily, 1580. Trade interests lie in furnishing the public wants, 1576-79, 1583. Refrigerated butter does not stand like preservatised butter, 1508-10, 1546, even when also preservatised, 1547. Such butter if kept may prove dangerous, 1547-51.

Declaration of preservative in butter not objected to *per se*, 1554-55, but not necessary, 1557-58; but the consumers' interest should be paramount, 1559.

Copeman, Mr. John Walton. (Digest of his Evidence.)

Represents London Chamber of Commerce, 1195; has been in preserved food trade 12 years, 1167; has known preserved pea trade some 18 years, 1244-45.

Preservatives mostly used in grocery trade are salt, saltpetre, sugar, oil, vinegar, and glucose, 1169-70. No experiences of modern antiseptics, 1171. Preservative action of copper-sulphate slight, 1189. In jam, sugar and colouring matters used, 1231.

Colouring matters used in anchovy sauce, 1178. Notification of use of artificial colourings would not lead to consumption of fruit in natural state, 1179-80. Coloured vegetables fairly well used, 1181-82. Colouring used in jam, 1231.

Carmine used in France for glacé and crystallised cherries non-injurious, 1178.

Copper in small amount used in France for greengages non-injurious, 1178. Sulphate used for peas, beans, spinach, and mixed vegetables, 1188. These goods unsaleable unless greened, 1184-87. Chlorophyll not a successful substitute, 1188. Amount of copper sulphate in peas varies from 2 to 2·8 grains per lb., 1190. One part in 10,000 in parts of Switzerland and Italy. Labelling alone required in certain American cities, 1191. Actual amount of copper contained known to be stated

Précis.

in America, 1222. No restriction in France, 1193-94, (App. No. 21.) No case of poisoning by coppered vegetables known, 1197, 1201-3, 1263, 1274, 1297-98. (App. No. 22); but the question of proof one of difficulty, 1264. No evidence of illness, 1198. No complaints known from London Clubs, &c., 1292. Fixation of maximum quantity of copper allowable advocated, 1199, specially on account of magisterial action, 1200, 1206-8, 1285. Some people have a prejudice against preserved foods, 1204-5. Quantities of metallic copper found in peas in France, 1209-14 (App. No. 20.) Analyses made in 1896, 1215, 1217-18. Minimum quantity requisite, about 2 grains per lb. of peas, 1240-43, 1253-56. Restriction to one-half this quantity would be impracticable, 1267. Maximum quantity desired about 2·7 grains of copper-sulphate per lb. of peas, 1215-16, and used in Kent, 1266. Larger quantity used in peas than in other vegetables, 1219-21. No copper naturally in peas though it is present in beans, 1220. No objection to labelling goods as artificially coloured; nothing more deemed necessary, 1222. Even this is not necessary in many cases, 1229. No objection to amount being stated, 1223-28, 1303-4. Medicinal use and doses of copper, 1260, 1299, 1302. In Germany brown peas used generally; in parts of France peas stewed *au naturel*, 1232. Copper prohibited in Germany, 1233. Peas may be two or three years old before consumption, 1234. After that they deteriorate, 1235. Preservation of colour for three months would be useless for trade purposes, 1236-37. Has no knowledge of actual manufacture of coppered peas, 1238-39, 1273-74. Has known the trade some 18 years, 1244-45. No difference noticed in colour of preserved peas in that period, 1246-47. French peas for home use and export differently treated with copper, 1249-52. Foreign laws as to coppering of peas have changed, 1249-52, 1271. Quantitative analyses of coppered peas not trusted, 1256-57. Copper not always evenly distributed in peas, 1258, but not a very strong poison, 1259. Strongly coppered peas would be uneatable, 1260-66, 1296. Colour keeping properties of peas with 1½ grain of copper sulphate per lb. not known, 1268, 1272, nor tested, 1269. No objection to such experiments being made, 1270. No one would eat more than ½ lb. of preserved peas, 1275, no one likely to eat 1 lb., 1276. If 5 ozs. of peas were consumed, not more than 1 grain of copper sulphate would be taken, 1301. Dry marrowfat peas largely used for soup, &c., 1277, 1279; used whole, 1278. Public will have peas green, 1283-84, 1286-88. Prohibition of sulphate of copper in peas would ruin the business, 1285. Greened peas in every restaurant in Ostend, in common use in Belgium, 1289. Greened peas fairly bright, 1290. Peas seven or eight years old thick and cloudy, 1293-94. Coppered peas not known to go off colour, 1296. Medical evidence in litigation cases considered of importance, 1305-6.

Sulphur used in dried fruit trade for bleaching raisins, apricots, plums, &c., 1172. Sulphur sometimes flavours the fruit, but keeps it a good colour, not known to be harmful, 1173; added to bloom of Carlsbad plums, and a small amount is used in champignons, 1174-76. Coloured goods generally preferred, 1280, and demanded, 1281.

Cochineal used freely in jams, jellies, &c.; it is non-injurious, 1176. Used in preserved cherries, 1178.

Sulphuric acid in jams and preserved fruit never heard of, 1177.

Turmeric used in piccalilli, &c., non-injurious, 1178.

Saffron is used, non-injurious, 1178.

Annatto (Spanish) used in butter and cheese, non-injurious, 1178, 1282.

CORFIELD, PROF. WM. HENRY. (Digest of his Evidence.)

M.A., M.D., F.R.C.P., Medical Officer of Health for St. George, Hanover Square, &c., 5070.

Preservative effects of salicylic acid and boracic acid specially studied, 5071. Salt is a constituent of the human body, 5085. Pyroligneous acid and saltpetre also used as preservatives, 5086. Preservatives likely to lead to neglect of cleanliness, 5113. Dairies, &c., Order needs enforcement, 5114. Preservatives to be avoided as not food, 5123, and should be judged harmful in the absence of evidence, 5124-25, that is, they should be proved harmless if use allowed, 5126-27.

Salicylic acid found chiefly in lighter kinds of wine, including British wines, with some prosecutions, and in light beers, 5072. Used externally the acid is an irritating substance, 5073, a most undesirable substance in food, 5074. People ought to know they are taking it, 5075. Continuous use possibly cumulative, 5076-77, and hence more seriously effective, but acquired immunity possible, 5078-79.

Boracic acid should not be used unknown to people in food, and should not be used in milk for infants and invalids, 5075. Probably only a certain quantity can be voided daily, 5080, and any larger dosage undesirable; the acid not being a food, 5081. Overdosage likely, 5082. Dose reduced by 50 per cent. in last edition of British Pharmacopœia, 5090. Used externally, but fallen into disuse for internal purposes, 5091. Got now elsewhere than in prescriptions, 5092. Some medical men still use it and believe in it, 5138-40, as a drug, 5141-44.

Prohibition of boracic acid desirable unless proved absolutely harmless, 5083, in all food, 5084; as also of saltpetre and pyroligneous acid, 5087. Milk trade need not suffer, 5088-89. Salicylic acid, borax, boracic acid, and soda prohibited in Austria, 5098; reasons for Continental prohibitions not known, 5099, 5100.

Digestibility of food must be inhibited if preservatives are effective, 5093, though experiments generally do not bear this out, 5094-96.

Contra-indication of salicylic acid and boracic acid in large numbers of persons, 5101-4, 5106-12, and indiscriminate use objectionable, 5105.

Milk on a different level to other foods *quâ* preservatives, as being the diet of infants and invalids, 5135. Objection as regards butter not so strong, 5136-37.

Experiments on animals not of very much importance, 5115. Results should not decide a matter, 5116, 5120, such as dosing children with drugs, 5117-18. Known action of the drugs on the human economy is the point of importance, 5121, and avoidance in the absence of such knowledge advocated, 5122.

Diarrhœa not known as associated with the use of preservatives, 5128-32.

Colouring matters not much studied, 5133-34.

CRIPPS, MR. RICHARD AUGUSTUS. (Digest of his Evidence.)

A fellow of the Institute of Chemistry, practising as an analyst at Hayward's Heath, 1932-35, 1968-72.

Boracic acid studied as it has effect in foods, 1936. Effect on digestive ferments studied as regards boracic acid, 1937-39, and as regards that substance only, 1974. Boracic acid in 1 per cent. solution has no detrimental influence as far as chemical experiments show upon salivary digestion, 1940, 1944. Not familiar with Weber's and Chittenden's experiments nor aware of their different results 1941-43, 1948. Boracic acid has no retarding influence on peptic digestion, as shown by experiment, 1944-47, nor on the rennet ferment, 1952. Borax has not the same action as boracic acid, 1949. Using zymin as a digestive agent showed slight retarding influence on digestion of strong boracic solution, 1952. The physiological action of boracic acid upon the system should determine the question of its use as a preservative, 1952, 1954-55, 1959. Experiments outside the human body not generally of much account, 1955. Phases of experiments described, 1940, 1944-47, 1951-52, 1960-67.

Milk should be free from preservatives, 1954, 1957.

Butter and cream as boracised would not affect digestive processes, 1958.

Colouring matters not studied, 1974.

DALE, MR. HENRY. (Digest of his Evidence.)

Is an Alderman of Cork, and represents the Cork Butter Exporters' Association, 237-38.

Butter heavily salted not now in demand, greater uniformity of butter called for, 241-42; and secured, 245; mild cured butter largely prepared solely for English market, 263; especially for South England, 264; most of it exported to a distance is in hermetically sealed tins, 272; and will keep a long time, 273, 277, and is sometimes sent without any preservative, 274; but salt is used, 275, though not a heavy amount, 276.

Salt has given way to preservatives in butter, 243; unsalted or lightly salted butter would not keep for twenty-four hours in hot weather without some preservative, 265.

Boracic acid is the base of all butter preservatives, 243, 269; it is called Preservitas, 271, and is mixed with the butter, 244, 251, 278-79, 318-20; three-quarters per cent. used constantly, 250, 290-91, which dissolves, 282; butter thus treated will keep three or four months, 292; less than one-half per cent. will not do, 287-89; no stipulation made to suppliers that preservatives be not used prior to butter reaching blending establishment; but the butter is examined, and such addition is not likely, though possible, 321-25.

Factories for butter-making in Normandy style general in Ireland, 246.

Creameries for butter-making in Danish style general in Ireland, 246.

Preservatives prohibited in Denmark, 247; cost about four times that of the salt required formerly to preserve butter, 252-54, namely, 6d. per lb., 283; but cost is infinitesimal per lb. of butter, 284-86. No knowledge of preservatives in cream, 338.

Prohibition of preservatives in Irish butter would affect its keeping quality, 248; and injure the trade, 256.

Danish butter consumed more quickly than Irish butter, 249; held to be of closer texture than Irish butter, 257; and to contain less water, 258; proportion imported very large, 260; owing to adoption of improved methods of manufacture, 261-62; it contains some salt, 265; it deteriorates if kept long, 300; but it is mostly consumed on arrival, 301-2; but travels far afield in competition with local produce, 313-15; additions of preservatives locally under these circumstances not known, 316-17.

No complaints of use of preservatives, 255.

Irish butter trade regaining lost ground, 261, 297; and much butter equal to Danish, 262; compares with Normandy butter as to saltness, 265; if Danish method adopted in Ireland the producer would be handicapped, especially in hot weather, 298-99; much Irish butter is shipped on chance of sale, 301; a good deal comes to London, 303-5; it contains 12-13 per cent. of water, 306-7; there are seasonal variations from 10 to 23 per cent., but no standard, 308-9; excess of water may go to determine the reason for preference for Danish butter, 310-12.

Normandy butter, preserved by wrapper soaked in preservative, would absorb the solution, 266; this method tried by some shippers, who also added preservative to the butter, 267; exclusive use of Normandy system not known, 268.

Colouring matter added to butter, 281, 326; only needed in Irish butter in winter, 327; fluid colouring used, saffron not now much used, though presumably one of the chief components, 328-29; colouring tested, but name not known to witness, 330-33; saffron and annatto were both used, and best retentive colour decided upon finally, 334; only vegetable colourings used, 336-37; no aniline dyes used, 337.

Period of transit from Cork and Denmark to England practically similar, 293-96.

Davidson, Mr. William. (Digest of his Evidence.)

Represents Scottish Provision Trade Association, as to hog meats in relation to preservatives, 1586.

Preservatives not used in the cure of meats, apart from salt and saltpetre, 1586-88, 1610. Necessary in hog products consumed by mill hands in heated atmospheres, 1588. Salt foods hurtful to such hands, 1599-1600. Less taken when much salt used, and more cheese eaten, 1601-3.

Borax used for sprinkling on outside bacon and ham, after cure, and washed off on arrival. Not used in hung hams, as it would permeate the meat. Any hams penetrated by borax not sold as fine meat, 1588-89. Should not be used for meats intended for hanging, 1615-19. Has known it to penetrate an inch, 1590, when put on moist meat, 1592, 1611-12. People would not eat borax-flavoured ham, 1591. Penetration tested by smell, 1604-8.

Australasian butters expected to contain preservatives, 1593; and believed to do so, 1597-98. Trade seasonal only, 1623-24, 1626-27, owing to climatic conditions, 1628, and sometimes output small, 1630, on account of drought, and lack of grass, 1631.

Danish butter accepted as containing no preservatives, 1594. Believes it contains some, 1595. Will have some analysed, 1596. Has lost its keeping qualities by reason of pasteurisation, 1596, 1614. It is an all-year-round butter, 1624-26. Cows housed eight months a year, 1629, and no food scarcity exists, 1630.

Taint of bacon is in interior of meat and has a flavour different to borax, 1608-9.

Cure of hog meat less prolonged than formerly, 1613.

Bacon trade a week-to-week trade, 1620-21.

Fresh imported meat not preservatised, 1632-33, but mildly cured on arrival in brine only, 1634.

De Hailes, Mr. Alfred James. (Digest of his Evidence.)

Analyst to the Dairy Protection Society, and their representative, and a Fellow of the Institute of Chemistry, 3899-3902, 3944-45, 4027-30.

Milk transit to London practically limited from a distance to two trains daily, morning and midnight, and morning's milk 24 hours old when it reaches consumer, 3903-7, 3948, and evening milk 12 hours old, 3908-13. Hence milk should keep some 24 to 36 hours, 3914, and requires some method of preserving it, 3915, and a boron base preservative is the best and safest, 3916. To restrict, as fresh milk, the sale of milk not fresh would be a hardship on distant milk-service vendors, 3939-40. Distance an important factor in regard of use of preservatives, 3948-49.

Small traders tend to be crushed out by organised trade, 3946-48.

Butter in Denmark unpreservatised now as a matter of protection against Irish competition, 3986-92, 3998-99. It was boracised until recently, 3993-98. Danish butter does not keep long, 4019-22. It is pasteurised, and hence acquires a distinct taste, 4023. Keeping quality of butter depends on use of preservatives, 4025-26.

Cream trade would cease if preservatives were forbidden, 3984, 4033; all London potted cream is preservatised, 3985. Cream keeps three days without preservative, 4034, 4036. Potted cream for trade purposes should keep a fortnight, 4035.

Preservatives largely used for milk in London, 3923-25, distance being an important factor, 3926-27, and present trade demands a preservative, 3928-29. Formalin and boron-base preservatives mostly used, 3930, the former being easy of application, 3931. Preservatives are necessary in both milk and butter 4003, 4016-19, but distance of source of milk all-important, 4004-9. Preservatives in milk the lesser of two evils, 4031.

Cold storage will keep milk fresh for some considerable time, say, milk cooled to 40°, 3917, 3950; many farms cannot cool to below 60°, 3917. Many farmers have not got cold water, 3918-21, 3951-56. Some of London milk trade does not use preservative, 3922. Preservatives the only cheap method of safeguarding milk, in view of absence of cold water at many farms, 3957-63. Cold storage would render preservatives in milk unnecessary to large communities, 4010; not so cooling of the milk, 4011. Aylesbury Dairy Co.'s procedure not known, 4012-15. Cold storage milk vendors are against the use of preservatives, 4031.

Pasteurisation and sterilisation change the character of milk, 3964-66, 3972-75, and the change may have grave effects on children and invalids, 3976. Continental general use of cooked milk not known, 3982-84.

Formic aldehyde should be prohibited in milk, 3966-68. Purchaser prejudiced by formaldehysed milk, 3969-70.

Boracic acid effects no change in milk, 3970, and milk boracised is hence fresh milk, 3971. No harm known to have resulted from boracised milk, 3976-81. Borax factory workers enjoy phenomenal health, 4036-41. Boracic acid recommended for use in milk in "Applied Chemistry," issued nine years ago, 4041-43.

Declaration of preservatives in milk impossible, and objected to, 3932-35. Not aware of system in United States, 3936-37, and notice to all customers impracticable, 3938, as also with butter, 3941-43. Labelling impracticable, 4001, and if declaration were alternative to prohibition, the latter would have to be enforced, 4002.

Prohibition of boracic acid in force in Austria, 4006.

Précis.

DUNN, MR. CHRISTOPHER J. (Digest of his Evidence.)

Represents Cork Butter Market Trustees, 3010-12

Butter sent to Cork seldom preservatised, 3013; factory butter has preservative added, 3013, 3015. Preservative generally some soluble borate of soda, 3013, 3051. Despite advice to use 1 lb. of preservative per 112 lbs. of butter but little Cork branded butter is preservatised, 3014. Foreign butter competes with Irish butter; Australasian butter takes the place of the old Irish winter trade butter, 3016, 3050. Danish butter largely pasteurised. One Cork Creamery also pasteurises. Factory butter could not be pasteurised, 3017. Doubtless much Danish butter is factory butter, 3018. Nothing in quality of Irish butter to necessitate a preservative, 3023. Irish butter keeps well; not so dry as Danish, certainly not so dry as Australian butter. Question of water investigated thoroughly by Munster Agricultural Institute, 3024, 3037-38. Results showed that dry salted butter keeps just as well as when mixed with warm pickle, 3025-26. Fresh butter not in question, 3027. No salt in fresh butter, 3028. Keeping depends on expulsion of butter-milk and water. Common belief that mountainous country butter keeps best, 3029. Keeping not affected by amount of water present, 3032-33. Reputation of keeping properties of Danish butter unknown, 3034. Danish trade for quick consumption, 3035. Irish salted butter used to be stored for months; public taste has altered this, 3036. Water nomally present in Irish butter, 14 or 15 per cent., 3039. If 18 per cent., butter not Cork branded, 3040, 3044; if 20 per cent. prosecution used to and might still ensue, 3040, owing to proceedings of like sort in Manchester, 3041-42. Over 18 per cent. would betoken negligence, 3044-46. Pressing out of water requires great care in hot weather, 3047; but very cold water in skilled hands would ease matters, 3048-49. Preservative frequently mixed with salt first, 1 lb. to 100 lbs. of butter, 3051, 3053. That quantity could not be added in the form of pickle, 3052. Considerable proportion of Cork trade passes through the Market, 3054. A very large industry, 3055.

Declaration of use of preservatives would not be objectionable, 3019-20.

Prohibition would not permanently affect the butter trade, 3018, 3021. It would serve the purpose of the home trade some think, 3021. Others dread prohibition, 3022. It would not greatly or long alter prices, 3050. Trustees of the Cork Market differ on the point, 3056. The Australian and Canadian butter would have to come frozen, 3057. Cold storage would in large degree meet the case, 3058. Difficulty as to Irish butter would lead to cold storage and frequent local demand as essentials, 3059.

Medical considerations should outweigh those of trade, 3060-61.

Colouring of butter going out. Only saffron and annatto known, 3030. Highly coloured butter, demand declining, 3031.

UPRÉ, DR. AUGUSTE. (Digest of his Evidence.)

Doctor of Philosophy, Fellow of the Institute of Chemistry, Public Analyst, and F.R.S., 5901.

Cleanliness may be discounted by the use of preservatives in milk, 5902-3. Guarantee of cleanliness lost when preservatives added to milk, 5905. Indeed dirt is cloaked by such addition, 5942-47. Milk of paramount importance *quâ* preservatives as being in cases an entire diet; not so butter, 5906. Fish should not be preservatised, 5907-12.

Preservatives objected to on principle, 5903, and indiscriminate admixtures of chemicals to food, 5904, irrespective of their effect, 5905.

Colouring matters of a poisonous nature should not be employed, 5913, in any quantity, 5914. Colours should be classified, 5918, and poisonous colours entirely prohibited, 5919. Harmless colours not objected to, 5931, but proof of character should precede use, 5932.

Quantitative analysis difficult in cases, e.g., boracic acid, to determine precise quantity, 5920.

Declaration of colours should designate poisonous colours as such, 5921. This would go a long way, 5937.

Prohibition of fraudulent colouring, as of "mixtures" and the like, advocated, 5938-41.

Copper in peas should not be allowed, 5915, 5917. Practice ceased some years back; now in force again to meet public demand, 5916. Effect of 1 grain per lb. of peas unknown. Some people idiosyncratic to minute quantities, 5922-25, and idiosyncrasy is very common, 5926-30. Colouring of peas scarcely fraudulent, 5933-36.

FABER, MR. HARALD. (Digest of his Evidence.)

Fellow of the Chemical Society, 4199, and Agricultural Commissioner to the Danish Government, 4200-2.

Declaration of preservatives should be made if they are permitted, 4203-4. Saccharine in beer and wine allowed in Denmark only if declared on the label, 4206.

Objections to preservatives lie in their chemical character, and action *quâ* decomposition of food in the human economy, 4205.

Preservatives not used in Danish butter, that is, in one-half of total foreign butter trade of England, 4317.

Prohibition of salicylic acid, boracic acid, and certain mineral salts in wines and spirits in Denmark, 4206, including salts of aluminium, barium, strontium, and magnesium, 4207. Salicylic acid prohibited since 1886, 4208. That and boracic acid prohibited as injurious to health, 4208-9, 4266, 4354-56, it being felt also easier to prohibit borax in butter prior to its use becoming general, 4267, and thus probably dangerous by use in many articles of diet, 4268-70. Only common salt allowed in dairy produce in Denmark, and no inconvenience results, 4210-11, even in Copenhagen, 4212-15. Prohibition of borax in butter had rather a present element of injury to trade, though a probable prospective advantage, 4271-75.

Norwegian and Swedish practices as to preservatives not known, 4312-15.

Butter in Denmark preservatised to a small extent only, prior to prohibition of preservatives, 4219-20, and then only by boron base preservative, 4263-65. Most butter is salted to some extent, 4221. Some sent not salted, some ½ per cent., but most about 1 per cent., 4222. Pasteurised butter adjudged the best, 4309-11.

Keeping quality of Danish butter keeps it for a minimum of some three weeks, 4223, 4277, in summer, and much longer in winter, 4318-22, for some seven weeks, and then it is sold as fine fresh butter, 4323-26, at top price, 4327-31. Price hangs on many factors, 4332. Results of experiments as to keeping quality promised, 4339 (App. No. 26). The butter not improved by preservatives, 4225, if butter well made, 4226. Nearly exclusively made of pasteurised milk, 4227, by reason of an Act aimed at checking the spread of tuberculosis in cattle, 4228. Keeping quality as good as ever, 4276. Some butter will be three weeks old on reaching retailer, 4278-79. being salted butter; saltless butter consumed more quickly, and only some 2 per cent. of whole export trade, 4280. One per cent. of salt will keep butter three weeks, 4281. The more water the poorer the keeping power of butter, 4282. Some 14 per cent. of water in Danish butter on shipment, 4283, some of which evaporates in transhipment, 4284. Probably more in Irish butter, 4285-89, though no necessity for it, 4290, and probably little difference in well-made Irish butter, 4291-95. Normandy factory butter drier than Danish, 4301. Its flavour varies, 4302, and the finest goes to Paris, 4303.

Soil, vegetation, or food generally does not affect flavour of butter; but the bacterial life does, 4296-99, and pasteurisation obviates all "feed taste," 4300. Flavour is produced by fermentation, 4304-5, 4308, not by breed of cattle, 4306-7, 4333.

Trade in Danish butter not affected by preservatised French and Irish butter, 4224. It is about half of foreign butter trade of England, 4316.

Sterilisation of milk by two large firms in Copenhagen, 4216, 4258, by pasteurisation; and cream also treated thus, 4217, in 97 per cent. of dairies, 4231, even before requirement that cream be pasteurised, 4309, and milk heated to 185° F., 4218. Pasteurisation does not interfere with flavour of butter, 4228, but colour test can distinguish pasteurised butter, 4229; not so the palate, 4230. It helps fermentation, 4231. Does not flavour milk unless the milk be heated to over 85° C., and need not flavour it, 4248-49; a matter of rapid cooling, 4250, even with 90° C., 4251-53. Raw milk avoided in Denmark; many people boil any unpasteurised milk purchased, 4254-55. Vending of pasteurised milk not the rule, 4256-57. One town demands that milk be pasteurised or drawn from cows which have stood tuberculin test, 4258. All towns have power so to rule, 4260-62. Necessity for pasteurising milk only related to prevention of cattle disease by tuberculosis, 4227-28, 4259. Pasteurisation medically recommended, 4334-36. Milk very often boiled on Continent, 4337-38. Perhaps 25 per cent. of Copenhagen milk supply pasteurised, 4340-43, and milk brought from distances of 120 miles, 4345-46. Infantile mortality of town not known, 4344. Milk cooled prior to train journey, 4347-48. Cost relatively to large trade small, 4349. Small farms cool with water, and factories or dairies with ice, 4350-52. Committee would be welcome to see Copenhagen method of treatment; that of Pasteur Milk Supply Company commended, 4353. Reference to bouquet of cream as produced by fermentative agents promised, 4357-59.

Bacon from Denmark a large trade, 4232. No present regulations as to preservatives, but prohibition intended in meat products generally, 4233, on ground of injuriousness, 4234. Borax only used, and that in limited amount, 4235, and it does not penetrate from outside, 4236. Injection of solution of salt containing borax is made into the meat in curing some bacon, 4237-40. Percentages given of salt in certain Danish, Irish, Dorset, and Wiltshire bacon, 4241-42, according to which injected meat might contain 0·4 to 0·8 per cent. of borax, 4243.

Agricultural pursuits occupy about half Danish population, 4244-47, in 1890, about $\frac{2}{5}$ths, footnote to 4247.

Fisher, Mr. Walter William. (Digest of his Evidence.)

Public Analyst, President of the Society of Public Analysts, and represents that Society, 4710-15.

Boracic acid not common in fresh meats; sometimes used in sausages; more commonly used in salt-meats, German sausages (under $\frac{1}{2}$ per cent), bacon, and ham (from $\frac{1}{3}$ to $\frac{3}{4}$ per cent). Found by Dr. Dyer in only one of 270 milk samples, 4717, but in 30 of 234 butter samples, averaging under $\frac{1}{2}$ per cent., two being over 1 per cent., 4717-21. Over 100 grains per gallon found in milk, and conviction obtained, 4736, 4762. Boracic acid is used recklessly, 4763-64.

Preservatives commonly used in dairy products, 4717. Not necessary in milk in rural districts, 4749, and none used as a rule, 4751; not needed in Oxfordshire, 4750.

Formalin, in milk in very small doses, as affecting the organism, not known of, 4729, 4738, but harmful properties suspected, 4730-31, to the point of withholding its legalisation in milk, 4767, until more is known of it, 4768. Effect on peptonised milk for invalids suggested as a matter for inquiry, 4743. Quantitative determination of formalin in milk accurately impracticable, 4753.

Hardening effects of formic aldehyde known, and dangerous properties pointed to, 4754-60, 4765-66.

Meat extracts generally free from preservatives, also potted meats, outside salt, 4717.

Sulphurous acid found in British wines, vinegars, pickles, &c., probably harmless as used, 4746. Beers not examined for years, 4769-70.

Restriction on the use of preservatives desirable, 4726, 4737, boracic acid in milk being instanced, 4728, and a superior limit called for, 4732, though some difficulty might arise in cases, 4733-35, and especially as to formaldehyde, 4741-42, at present, 4752; limit should be placed on preservatives on salted and preserved meats (as ham and bacon) and fish, 4745.

Declaration of preservatives should be made in some cases, 4726, as in milk if permitted, 4728. No resolution passed by Society of Public Analysts, 4744. Declaration of milk as formaldehysed would not guarantee against a harmful dose, 4761.

Prohibition of preservatives should be enforced in some cases, 4727, and entirely in new milk, 4728, and new cream, fresh fish, and fresh meats, 4745. No resolution passed by Society of Public Analysts, 4744.

Colouring matter, red ochre, used in bloater pastes; German sausage skins sometimes dyed, 4771, 4775-77 Nitrites poisonous in large doses, not as used for meats, 4771. Some meat preservatives are coloured, 4772-74. Some colourings named, 4778. Temperance drinks coloured, 4779. Chromate of lead and oxide of iron known to be used, 4780. Jellies coloured, 4793, with small quantities of colouring, chiefly yellows and reds, 4794.

Copper in peas in an unsatisfactory position, 4781. as to effects of the copper, 4782. Used probably to give green appearance to peas, 4783-85. Use is objectionable, 4786, on the ground of health, 4787. Use thought of as fraudulent, 4788-92. No experiments made, 4795.

Foulerton, Mr. Alex. G. R. (Digest of his Evidence.)

Fellow of the Chemical Society, and of the Royal College of Surgeons, &c., 4044-46.

Milk requires preservatives to a certain extent, 4047. Preservatives should be added immediately after milking, 4050. When now added not known, 4051-52. It is desirable to prevent bacterial activity by early addition of preservative, if allowed, 4053-57. Almost impossible for London poor to get good fresh milk, 4058, at present, 4059. Large vendors can do without preservatives, 4060. Distance an important factor, 4061, 4128. Interests of small vendor not superior to those of general public, 4062, who would not suffer if he disappeared, 4063, if milk supply could be otherwise kept up, 4064. Milk can be kept sweet by $\frac{1}{50000}$ formic aldehyde and $\frac{1}{2000}$ boracic acid, 4048-49, 4080. Company vending former recommend $\frac{1}{50000}$, 4082-85. Mr. Thompson held that $\frac{1}{8000}$ formic aldehyde and $\frac{1}{2000}$ boracic acid kept milk sweet for a week, 4086, at room temperature, 4087. Chief London agencies look to sanitary condition of dairy farms, 4108-11. State of farms a factor in determining the keeping quality of milk, 4112. Even if cooled, milk will not keep 24 hours in extreme heat, 4115-18, 4134-35, though it will in ordinary weather, 4119 Milk often kept in filthy circumstances in poor district houses, 4120-22, 4128, 4173, and on vendor's premises, 4170, 4173, and hence preservatives needed, 4123-25, but the conditions should be removed, 4126, 4171-72, and if this were accomplished preservatives would become unnecessary, 4127. A large milk trade in small vendors' hands, 4129-30. If Birmingham has 91 per cent. of its milk free from preservatives, that is an element against the alleged necessity for preservatives in milk, 4131-33. Vienna, circumstances of milk supply not known, 4134-36. Preservatised milk not proper for invalids, 4147, nor children, 4148. Would not allow 80 grains of boracic acid in a pint of milk, 4155. Aylesbury Dairy Company use no preservatives, 4158, and draw milk from a distance, 4159. Nothing to prevent consumers adding preservatives to their milk, 4174-75, but the poor should not be left to add them, 4176-80, but practice not personally known, 4181.

Preservatives used for other foods than milk, 4068, but not so necessary, 4069. Use does not counterbalance uncleanliness, 4113-14. Any premium placed on cleanliness to be deprecated, 4137.

Boracic acid as used in milk harmless to ordinary individual, but probably hurtful in cases of infants and invalids, 4047. But $\frac{1}{2000}$ would be safe, 35 grains per gallon for an individual taking a pint daily, 4048-49.

Formic aldehyde would perhaps render milk a little less digestible, 4047. But $\frac{1}{50000}$ safe for ordinary individual taking a pint of milk daily, 4048-49. Not known that the Formalin Company always advised use of limit of $\frac{1}{50000}$, 4107. Quantitative determination not known, 4142, but probably impracticable, 4143; and hence danger arises *quâ* use in food, 4144. Its use for persons on milk diet injurious, but not for ordinary persons, 4146.

Experiments made in conjunction with Dr. Rideal, 4077-78; and his work as to boracic acid and formic aldehyde known, 4079; but resulting demonstration of small effect of use of those preservatives not known, 4081. Has found $\frac{1}{50000}$ formic aldehyde to keep milk sweet overnight in summer, 4088-91. Change of milk detected by taste and smell, 4092-95. Exact composition of sour milk not known, 4096-98. Lactic change not due to any one bacillus, 4099-4105; though lactic acid primarily in question, 4106. No taste could discriminate below 0·4 per cent. of lactic acid, 4182-84. Dr. Rideal's experiments in his Table (App. No. 24) show not the slightest effect accruing from use of preservatives in milk in 24 hours, but do not determine the fact of possible unfitness of the milk for food, 4185-86. Fish died in a few hours when subjected to $\frac{1}{20000}$ formic aldehyde, 4138; which is a powerful poison in undiluted form, but not poisonous as used in milk, 4139-40; but double dose in milk would lead to consumption of liquid fatal to fish in five hours; but $\frac{1}{10000}$ had no effect on action of frog's heart, 4141. Normal saline solution used, 4163; and no chance of fixture of formic aldehyde occurring, 4164-66. Formic aldehyde and boracic acid as preservatives have but little effect on the digestibility of food, 4160. Digestibility of sterilised milk said to be less than ordinary, 4161-62.

Contra-indication of milk preservatised with boracic acid or formaldehyde very common, 4149; and may include healthy persons, 4150. "Preserved" milk now held to mean condensed milk, 4151. Both equally injurious for children, 4152.

Sterilisation would help to keep milk, 4070; especially if bottled, 4071; but then expensive, 4072; as illustrated by Paris hospital practice, 4073; but expense mainly a matter of management, 4074-75. Sterilisation would be beneficial in the interests of the community, 4187; but its destructive effect on the tubercle bacillus doubted, 4188-93; but the heating of milk to 65° Centigrade would be a benefit, 4194. If practicable sterilisation would be the best thing, 4198.

Germicidal action of boracic acid and formaldehyde on certain bacteria inhibitory rather than destructive, 4195-97.

Scheduling of certain preservatives to be authorised a matter for inquiry, 4167. Preservatives are a changing quantity, 4168-69.

Declaration should be made of preservatives in milk, to safeguard infants and invalids, 4047. Desirable from public health point of view, 4065. Trade interests should not stand in the way, 4066. Exact nature or amount need not be declared if officially fixed, 4067. Declaration favoured rather than prohibition, 4076.

Prohibition of preservatives or a "leave-alone" policy the alternatives if limitation of maxima impracticable, 4153-54, and the former inclined to as regards chemical preservatives, 4155-56, that is, total prohibition, 4157.

Gibson, Mr. Robert. (Digest of his Evidence.)

Salesmaster of Limerick Public Creamery Market, &c., 6310-11. Represents South of Ireland Butter Merchants' Association, 6364.

Irish fresh butter trade depends entirely on preservatives, 6312-13, and these necessary for Irish salt butter also, 6314. All butter controlled by witness is preservatised, 6328, 6373. Trade will require preservatives until defects in present system are righted, and butter is no longer required to keep as now, 6361, 6385, 6390-92, 6395-96. Danish butter contains, some of it 2½ per cent., and some 3 and 4 per cent. of salt, 6361-62. Salt tends to evaporate, 6363. No complaints of preservatised butter, 6374-75, but complaints of unpreservatised butter, 6376. Trade increasing in Ireland, 6396.

Keeping power of Irish saltless butter under one week without preservative, but a fortnight at any rate with preservative, 6314. Salt preservatised butter keeps for four months, 6315-16, 6376. Irish butter essentially a keeping butter; not so Danish and Normandy. Irish butter trade mainly summer trade only, 6317. It need not be so, 6323-24, as witness has endeavoured to show farmers, 6325, with some success, 6326. Danish butter all-year-round trade, 6318-19. Calving cows largely housed in Ireland in winter, 6320. Irish trade such that butter must keep for months, 6353, 6394, and does, and commands good price, some being preservatised, 6354-55. Butter experimented on kept nine months with preservative added, 6364. Irish butter keeps much longer than Danish, 6393.

Transit of butter from New Zealand under best possible conditions, 6331, from Ireland and in England under very worst possible conditions by railways and steamship companies, 6331-33, 6343-45; many complaints, 6334, and practically no redress, 6335. Specific complaints instanced, 6332-33, 6337-42. Danish and Swedish Governments see to such a matter, 6336, and get a better service, 6386-89. No improvement in handling the butter by railway companies, 6346-49. Improved transit needed, 6397.

Education of Irish butter-makers at fault; Danes well educated, 6357-60. Improved education needed, 6397.

Price of Irish winter butter higher than best Danish, 6326, 6404, some of the former being salted and some saltless, 6327.

Cold storage non-existent in Ireland, 6379, and price of ice there prohibitory of refrigerating plant for general use, 6380-84. Creameries have cooling tanks, not so the farms, 6401, and the milk travels long before cooling is accomplished, 6402-3.

Cleanliness not enforced at nor proper inspection made of Irish farms; and creameries also need looking to, 6404.

Preservative in Irish saltless butter, 1 lb. to 112 lbs., 6328, 6377, analysing out to 0·8 per cent., and quite sufficient, 6329, 6378, 6400; 3 lbs. of salt added make a salt butter, 6330. Use of preservatives in butter a question of rapidity of consumption, 6350. Consignees of witness know of preservative in butter, and private clients demand it, 6351. Borax and boracic acid the base of all the preservatives used, 6357. Preservatives will remain requisite till present defects of manufacture and the necessity for storage are removed, 6394-99.

Flavour of salt preservatised butter milder than such butter without preservative, 6356.

Creamery butter about $\frac{1}{7}$th of Irish trade, 6368-69.

Margarine made in Ireland, 6371-72.

Declaration of butter as preservatised not objected to, 6352.

Milk in Ireland in winter months sent into towns, thus interfering with butter trade, 6317, 6321-22.

Colour of butter debateable point in Ireland. Witness holds it essential to meet varying local tastes, 6364, 6369-70. Colour cannot be kept constant by food; it can by having Jersey cattle, 6366-68. Colouring enables margarine to be sold as butter, 6364, 6370.

Prohibition of colouring of butter would lead to seasonal changes in natural colour and give dissatisfaction, 6365.

Gilbey, Mr. Alfred. (Digest of his Evidence.)

Partner in the firm of Messrs. W. and A. Gilbey, 4360.

Preservatives, other than brandy, unnecessary in wines imported to this country, 4361, 4371, 4380. Salicylic acid heard of years ago in cheap Spanish wine, 4362, Tarragona, 4369, and known in wine-producing countries, 4363, really in inferior wines, 4364. It is a preservative, and reduces the amount of spirit required, 4365, arrests fermentation, and is easily detectable, 4366-71. Not known in this country, 4366-67, 4371-75, 4379, 4392, 4404. Light Portuguese wines not likely to be imported, unless fortified or preservatised, 4376, and not known to be imported, 4377-78. "St. Julien" made on banks of Thames extremely likely to contain salicylic acid, 4381-86. Mineral acids in wine not known, 4405-6.

Prohibition of salicylic acid in wines contracted for by Messrs. Gilbey, 4362, the acid also being prohibited in many wine-producing countries, 4364, 4380, including France, 4370. Formaldehyde also prohibited by Messrs. Gilbey, 4368. Their wines tested for preservatives, 4396, 4403 and footnote.

Colouring matters, other than grape juice, not needed in wine, 4361. "Colour wine" used, but little colouring matter, 4387, 4393. Alum not known, 4388. Probably burnt sugar and glucose in liqueurs, 4389. Salts of copper, picric acid, or cochineal not known, 4390-91. No excuse or need for colourings even in cheap wines, 4394-95. Messrs. Gilbey's wines tested for colouring matters, 4396-4403 and footnote.

Gregson, Mr. Chas. E. L. (Digest of his evidence.)

Represents the Liverpool Provision Trade Association, 856.

Borax and boracic acid not used thirty years ago; borax used in small amount twenty-five years back; it is now driving out salt packing; mild cured meat required by the public, 858. Borax packing keeps it mild, 894-95, and free from slime, 896. Borax used for 75 per cent. of American and Canadian meats, 859, 876. Neither borax nor boracic acid used in curing meats, 864. Borax applied to surface of meat after curing, 865, in a dry state, 866, and only so, 891-93, 900-1; it remains dry, 929, and is all washed off over here 867, 869-70. Its retention would flavour the meat,

868. Application to meat closes the pores, 871. Taint and fly-blow obviated by use of these preservatives, 873, 881-82. Taint generally a matter of bad or imperfect curing. Borax will not save meat that has gone bad, 916-18. Taint occurs before cure is complete, and fly-blow afterwards, 919-20. No complaint of borax-packed meat except by the trade recipient when borax had not been completely removed in washing, 874. One per cent. used and needed for preservative purposes, 877-80, 883-87, 1 lb. per cwt. of ham, 924. Borax expensive, 887, about 6 or 7 cents per lb. in America, salt being 30s. per ton, 888. Borax would keep meat a month in reasonable weather, 889-90. It is not absorbed, 898-99. Pumping of solution into meat vessels not known, 902-3. Borax not advocated, but used because demanded, 903.

Prohibition of borax would curtail the bacon trade, 875.

Injury to health from boracised meat unknown, 915.

Salt used now for packing 25 per cent. of American and Canadian meats, 859, which come hard-salted for the Irish trade, 860-61, but even Irish trade in mild cured meats is growing, 862. Meats packed in salt arrive too salt for public taste, 871, 875, 896. Salt is absorbed by the meat, 897, 931-33. Percentage of from 5 to 10 used in cure, 927, and even 20 per cent. if hard-salted meat needed for Ireland. A good deal of the salt runs to brine, 928.

Pickle curing used for some American meats, 865, known to be pumped into meat vessels, 902-3.

Bacon and ham from America might possibly be cured this side by the use of refrigerators; the experiment has, however, failed commercially, and it is risky for the meat, 905-8, 921-23; cost also is against it, 909-13.

GRÜNBAUM, DR. ALBERT. (Digest of his Evidence.)

M.A., M.D., M.R.C.P., and Lecturer on Chemical Physiology in the Liverpool University College, 6405-6, 6481.

Continental legislation as to food inquired into, 6407; principally in Germany and Austria, 6408; as to preservatives in food, 6409.

Prussian ministerial circular totally prohibitive of preservatives in food, 6410; and local bye-laws made in the same sense. Preservatives in milk totally prohibited, 6411, 6413-14, 6432; as also in wines, 6411-12. Milk dealt with on account of impossibility of fixing standards for the Kingdom, 6415; and because harm from use of preservatised milk was feared, 6433-34; especially as to children 6435. Proceedings taken at Hamburg and elsewhere as to preservatives in milk, 6416-17; and as to sodium sulphite in minced meat, 6418; the substance being injurious to health in small amount. 6419-20. Germany seeking to prohibit preservatives in meat, 6423. Experiments were made as a basis for existing legislation, 6436-38, 6442, 6465. Formalin used, but very rarely found, 6439; the same as to salicylic acid, 6440; as regards milk, 6441. Expert evidence has been taken in Germany as to results following the administration of sodium sulphite, 6442, 6445; even in small doses, 6447; namely, headache, diarrhœa, indigestion, and catarrh, 6446. Found in minced meat, a food for invalids, from 0·08 to 0·86 per cent.; not found in milk, 6444-45, 6447. Medical profession against preservatives, 6457-58; on general principles, and as not knowing when patients were taking them, 6459. Berlin milk supply unpreservatised, 6459-62. Distribution in closed vessels, 6470-72; and in bottles in the smaller towns, 6473-74. Evidence as to preservative legislation mainly concerned with milk and minced meat, 6466. Preservatives forbidden in beer in Germany, 6467, 6469. Milk sent by rail in ice-cooled vans, 6477.

Copper sulphate in peas held in Germany to be harmless in amount required, 6448-49, and not prohibited in minute quantities, 6450-51. Laws of other countries not known, 6452-56.

Vienna has bye-laws prohibitory of preservatives in food, milk being especially in question, and sodium carbonate being included in the prohibition, 6421-22, 6464. Ministerial decrees in Austria prohibit specified preservatives and colouring matters, 6426-27. All preservatives are prohibited in milk, and Hungary is seeking to prohibit all preservatives, 6428. Present action in contemplation in Austria not known, 6429-30. In Vienna only one sample of milk in one year found to be preservatised, and that by a large quantity of sodium carbonate, 6463. Preservatives forbidden in beer in Austria, 6468-69. No evidence as to use of saccharin procured, 6475.

Switzerland prohibits borax and boracic acid in imported meat, 6423-25.

Preservatives should be prohibited, as injurious to cells of the system, 6476, 6478; in other substances as well as milk, and including sodium sulphite and boracic acid. A septic rather than antiseptic food should be aimed at, 6477. Digestion at times affected by preservatives, 6479.

Declaration of preservatives advisable, 6480.

Experiments on animals valuable on certain defined lines, monkeys being preferred to cats or dogs, 6482, and with positive results as to preservatives, 6488-90. But, weight for weight and age for age, animals stand unnatural food better than the human, 6482-83. Pig said to approximate to man in structure, 6484-87.

HALLIBURTON, PROF. W.D., M.D., F.R.S. (Digest of his Evidence.)

Professor of Physiology, King's College, London, F.R.C.P., and nominee of Royal College of Surgeons, 7525-26.

Physiological experiments form the basis of evidence to be given, especially as to boron compounds and formaldehyde. Continuous use of antiseptics objectionable on general principles, 7528. Even salt immoderately used has been injurious, 7529-30. Germicidal substances hostile to man in food, 7528-30. Economy of dog more resistant than that of man, 7565-66; metabolic processes of dog and puppy much the same, but diet varies, 7567-68. Experiments of Dr. Annett not known, as to boracised kittens, 7569-70.

Borax and boracic acid have caused skin eruption and dyspepsia, 7541-49. Borax more readily soluble than boracic acid, 7543. Admixtures of both commonly used in the form of glacialin, 7544. Harmfulness of continued use of borax on kidneys held. Mal-nutrition of infants fed on boracised milk instanced. Digestibility of milk interfered with by minute doses of borax, but not of boracic acid, 7545, 7548. Milk that kept good with borax added, went bad with a similar quantity of boracic acid, 7546-47. Borax a more efficient antiseptic than boracic acid, 7548. Liebrich's pamphlet on the action of borax thought of as biassed, 7558-64. Boracic acid least harmful of preservatives, 7578-79. Experiments of Foster and Chittenden known; latter shows boracic acid as innocuous in certain quantities in the case of dogs, 7591-94.

Formaldehyde a marvellous antiseptic and inhibitive of digestion in minute quantities, 7548. Is absolutely opposed to its use, 7572; and the indigestibility of food by its use held to be proved by experiments *in vitro*, 7583-85. Commercial formaldehyde known to be used in milk in $\frac{1}{2000}$, 7586-88. Would not flavour the milk, 7589-90.

Salicylic acid effects little known by witness, 7571.

Prohibition of all foreign substances as admixtures in food to be desired, 7530, 7573-77. May be difficult, but is ideal, 7578. Prohibition of formaldehyde should be absolute, 7548, 7550, also of salicylic acid, a dangerous drug, 7551-53. Nitrate of potash should be prohibited, 7576.

Declaration the alternative to prohibition of preservatives; it would meet the case of idiosyncratic people, 7532-33. Borax should be notified, 7542; important to the public generally, 7543.

Cold storage to be preferred to preservatives for food, 7530-32.

Sterilised milk not known to be harmful, 7580-82.

Pasteurisation of milk likely to alter and render less digestible the proteids in milk, 7601-14, but any specific toxic action brought about by boiling of milk must be very slight, and if existing should have been discovered long ago, 7614-21. No poisoning effect to be feared from re-arrangement of inorganic phosphates in milk, 7622-23.

Copper accidentally in canned foods, apart from its use as a colouring agent, 7534-38. Harmfulness of copper in peas depends on quantity used, 7554. Copper in peas to be condemned, 7555, 7557, as a foreign substance, and cumulative; no copper normally in the human body, 7556. But no experiments made by witness, 7595-96. Cumulative effects likely to become increasingly harmful, 7597-7600.

Précis.

Colouring milk caused dyspepsia in an infant, 7538. Better to avoid artificial dyes, 7539; though public taste known to be arbitrary, 7540.

HANDFORD, DR. HENRY. (Digest of his Evidence.)

Honorary Physician to Nottingham General Hospital, Consulting Physician, Medical Officer of Health for Nottinghamshire, 2259-62.

Boracic acid as a food preservative studied, 2263 The acid used in a variety of foods doubtless, 2281, and risk thus run by consumers, 2282.

Dose of boracic acid for adult, 10-15 grains, and for infant 1-15th of that, 2270. Has prescribed it moderately, 2289. Intermittent medicinal dosage recommended, 2290, owing to very frequent complaints of discomfort caused by its maintained use, 2291. Would not use it in nephritis, 2292-93. Action on uterus not known, 2294. Has given it for epilepsy; appetite failed, 2295. Would object to a fever patient having any boracic acid, 2302-4. A medical man should know if a patient be already taking any boracic acid, 2305.

Cooking would equably distribute powdered boracic acid in milk, 2274.

External use made of boracic acid as a lotion and dressing said to have led to bad results; has not himself seen any, 2283. Relatively harmless as an external drug, 2264.

Internal use of boracic acid shows it to be an irritant and cause of loss of appetite, 2264; in sickness, probably also in part in healthy individuals, 2265. Thirty grains a day taken by some persons for long periods with apparent impunity; others get discomfort in a few days. Some continue drug, notwithstanding its unpleasant results, which come and go as its use is maintained or omitted, 2266. Use in stomach not known to have caused ill effects, 2284. Gastric disturbance has followed its use for cystitis, proportion of cases not known, but from 20 to 40 per cent., 2285-87.

Contra-indication of boracic acid not alone in fever, but always save when direct benefit from the drug is expected, 2303.

Prohibition of preservatives in milk might in great measure be absolute, if cleanliness were ensured, 2276; and cold storage adopted, 2322. Dairies, &c., Orders need enforcement, 2323-24.

Declaration of boracised milk impracticable, 2275.

Preservatives increasingly in use, but not much known to medical men, 2277; including boracic acid, 2296-97; hence results of use not generally known, 2298, or traced, 2299. Other preservatives not studied, 2300-1.

Diarrhœa in a child seven months old, held to be related to boracised milk, 2267; not a crucial case, 2311-12. Two pints taken daily by child, 2268, and some 7 grains of the acid, 2269; a heavy dose for the child, 2270. Milk free from boracic acid substituted, 2271, and child slowly got well, 2272. Effect of change of milk not studied in other cases, 2314-15. Such dosage could only have prejudicial effects, 2273. Diarrhœa read of as caused by boracic acid, 2288.

Milk in children's hospital found to contain 28·96 grains of boracic acid per gallon. Its use discontinued, and unpreservatised milk contracted for, 2267, as the result of observation in one case of diarrhœa, 2313. Decomposed milk disguised by boracic acid, 2278. Milk should not be boracised, 2302-4, 2319. Milk putrid more harmful than if sweet and moderately boracised; but such putrid milk would not be purchased, 2306. Putridity would be checked and veiled by boracic acid, 2307. Both the acid and the ptomaines might be taken, 2308. Their corrective action not a reasonable assumption, 2319. Milk for the poor and rich in regard of guarantee of freedom from preservatives not on same footing, 2310. No experience of ptomaine poisoning by milk, 2316-17. Boracic acid would not neutralise effect of ptomaines, 2318. Milk would not be recommended by medical men in large quantities unless guarantee of freedom from boracic acid were assured, if its use were sanctioned, 2320, with mischievous result from such restricted milk diet, 2321.

Cream increasingly in use for infants and invalids. Boracic acid largely used in it, 2278. Not known how added, 2279. Has heard of powdered particles being visible, 2280.

Fish unfit for food rendered saleable by use of boracic acid; danger is marked, 2278.

Meat, fresh, dusted with borax: evil results have followed, 2280.

HARRIS, MR. JOHN MITCHELL. (Digest of his Evidence.)

Deputy Chairman of the Bacon Curers' Association, &c., 5948-50.

Bacon of Wiltshire brand cured by Harris and Co., of Calne, 5951-53. Salt and saltpetre used in the cure, 5954, and these alone, 5955. English bacon trade very small compared with American trade, 6015-17.

Borax packing used in American and Canadian bacon trade, 5961. If it does not get into the meat no harm done, 5962. No experience of the practice, 5964, nor of the trade, 5966. American bacon cured with salt and saltpetre and packed in borax, and this borax washed out over here, 5967. Borax not used for curing in home trade, and rarely in Ireland, 5979. Borax not personally objected to, 5980. French conditions as to presence of borax in imported bacon not altered, 5999, as experience has shown recently, 6000, but rather they are stricter, 6001. Temporary withdrawal not known of, 6014. Borax has no aroma, 6004-6. Much the larger part of bacon coming to English consumer is borax-packed, 6018.

Declaration of borax should be made, 6035, and would do away with present injustice to English bacon trade, 6036.

Smoked bacon would not do from America, 6037-38. "Smokine" known, but not used by best curers, 6039-41.

Penetration of meat by sprinkled borax demonstrated by experiments, 5968-78, 6019-27.

Price of Canadian bacon the inducement to buy it, but English curing of bacon greatly on the increase, 5981-85. American bacon goes mostly to poorer districts, 6018. Price of bacon if borax prohibited would only be affected as mode of carriage increased in cost, 6028-33. If America and Canada charged English prices they would sell no bacon, 6034.

Mild-cured bacon possible without the aid of borax, though perhaps nothing better known for use from America, 5986. It can be so produced and exported, 6007. Injection of borax in brine very seldom made, and quite unnecessary, 5987. Mild-cured bacon was possible before preservatives came in, and trade now all year round, 6002-3. It is exported to greater distances than America, and in a state fit to go to the seller, not in a green state like the American exported meat, 6008-9.

Export trade of Harris and Co. large, 5956, 5988, but larger part of trade is home, 5989. Dried bacon packed in salt, 5957, in canvas bags in dry salt in cases for India and the Cape, 5958-59. No occasion found for borax packing, 5960. Canvas keeps out the salt, 5963. Method quite satisfactory, 5965. Bacon sent abroad is a little more salt and extra dry, 5990. Sent to India, Cape, China, &c., 5991-92, 6010, to hot climates, by steamship, 5993, probably in cool chamber, 5994. It is packed in the hold, 5995-96, and is in high temperature in many cases, 5997. No complaints received, 5998. Boracised bacon sent abroad from America by way of England, packed like English bacon, 6011-13.

HATTERSLEY, MR. I. A. (Digest of his Evidence.)

Managing Director of Aylesbury Dairy Company, 5766-67.

Milk supplied to Aylesbury Dairy Company from distances up to 200 miles, 5768-70, 5846, even in summer, 5847, and free from preservatives, 5771-72, as being unnecessary, 5773-76, and from a protectionist policy many years ago perhaps, 5776. Stipulations as to non-use of preservatives with contracting farmers, 5776, 5882-83. Only 78 letters of complaint as to sour milk out of upwards of five million deliveries, 5776-77, 5875, and these chiefly owing to improper treatment of milk by customer, 5832. No difficulties of transit by rail, 5778. Milk occasionally sent in a fish truck, 5779-80. Precautions adopted to secure proper milk supply from farmers, 5818-19, and farms inspected, 5820. Churns sealed during transit, 5824-26. Trade of Company 1½ million gallons yearly, 5841-43, from 50 farms, 5844, averaging 50 miles away, 5845. Some 100,000 persons supplied annually, in 14,000 households, 5848-53, over a wide London area, 5894-95. Milk comes to Paddington and Euston, 5896-97. Many poor-class customers, 5898. Milk rarely required to keep more than six hours after delivery to houses, 5878, or customer would scald it, 5880. Treatment in house important *quâ* keeping power of milk, 5881, 5899. Some nursery milk delivered in bottles, 5884-86, from special farms, 5893. Bottled milk entails expense, 5887-88. Paris has bottled milk, at 6d. per quart, 5889. Copenhagen gets both bottled and can milk, 5890-92.

Cooling of milk on milking insisted on, 5781, as essential to its keeping, 5782, 5821-24, also straining, 5819. Water supply of farms traded with looked to as proper, 5827-31, also the sanitary condition of the farm, 5830, 5882-83, 5899-5900. Cooling of milk only at fault once in 1899, 5832-34.

Pasteurised milk has little demand, 5783-84, milk heated to 160° F., 5785.

Sterilised milk demand increasing, 5784. Milk heated to 212° F., 5785, and fairly large trade done by Aylesbury Dairy Company, 5786. Delivered in bottles, 5885.

Cleanliness of milk churns ensured by treatment by Aylesbury Dairy Company before return to farmers, 5786.

Cream collected by Aylesbury Dairy Company in London, except one supply from Sussex, 5787-88. No preservative used, 5789, even in clotted cream, 5791, also made in London, 5792. Only one verbal and one letter of complaint of cream per 2,000, and 20,000 quarts respectively, 5790, and less frequent relatively than as to milk, 5872-78. No preservative required for Devonshire clotted cream sent to London, 5793. Clotted cream keeps longer than ordinary cream, 5794-95. Grocers sell cream because they can preservatise it, 5854-56.

Butter churned by Aylesbury Dairy Company contains no preservative, 5796-97. Imported French butter contains a preservative, 5797. It is a factory butter, 5798-99. Preservatives seem necessary to Normandy saltless butter, 5800-1, 5835, system at fault, 5836. Fresh butter sales increasing, 5837, Company's sale doubling in five years, 5838. Why not known, 5839-40.

Margarine not dealt in by Aylesbury Dairy Co., 5806.

Colouring matter used by Aylesbury Dairy Co. to secure continuity of colour all year round, 5802, 5804-5. Would be glad to be able to do without it, 5802, in milk, 5815. Customers demand coloured milk, but little colour used in summer, 5803, and will have it, 5857-60. Repeated attempts to do without colouring milk have failed, 5861. Complaints have followed its temporary disuse, 5866-69. Colouring of margarine by the trade neither honest nor desirable, 5806-13; does not hurt the Company's butter trade, 5814. Has no opinion to offer as to the colouring of cheese, 5816-17.

Hehner, Mr. Otto. (Digest of his Evidence.)

Public Analyst and Fellow of the Institute of Chemistry, 5562-63.

Preservatives in food extensively studied, 5564. Nearly always boric compounds in cream, 5584. Not necessary in food generally, and misleading to the public, 5593, 5634-35. Originally used in butter collected from farmers in small quantities, 5595. Regulation required of quantities of preservatives permissible, 5605, in gradually diminishing amount in butter, as facilities to obviate their use come in, 5606. Nitrate of potash not to be condemned, rarely met with, 5636. Drugs objected to as preservatives. Salt is a food, 5637-38.

Boracic acid tastes butter, and public palate is getting seasoned thereto, 5605. The only preservative to be condoned in any way, 5614, and solely in butter, in annually diminishing quantity to vanishing point, 5615. Probably three-fourths of imported butter preservatised, 5616-19, 5631-33. Boracic acid prohibited in butter used in France, 5619-22. Used for meats, ham, bacon, sausages, herrings, &c. 5623-27.

Formalin never found in butter, 5610. As a preservative should be prohibited, 5611. Personal experiment therewith, $\frac{1}{5000}$, resulted in illness, 5612-13.

Milk samples largely free from preservatives, though both formalin and borates found, 5576, that is in country milk, 5577-79. No necessity for preservatives, 5580, 5607. Milk of a large London dairy company free from all preservatives, 5581. Preservatives in milk should be prohibited, 5608.

Cream as sold by milkmen rarely preservatised, 5576, 5581. Cream from grocers almost always preservatised, 5582-83, always boric compounds, in many cases 56 grains per lb., 5584. Grocers' trade in cream calls for preservatives, 5585-88, and induces them to use them, 5589-91, and mislead the public as to keeping quality of cream, 5592.

Butter samples numerously examined for preservatives, 5564, and 90 per cent. contained them, 5565, always boric compounds from very small quantity to 1 per cent., 5566. Butter which reaches the consumer quickly needs no preservative, 5594-95. Bulk of fresh butter goes to better class, 5596-98. Demand for saltless butter may have to do with use of preservatives, 5599-5600; but some butter, *e.g.*, Danish, free from preservatives, and practically also from salt, 5600-1. Danish butters good, and command a high price, 5602, and no difficulty arises in vending them, 5603.

Margarine requires no preservative, 5599, 5603. No need for boracic acid, 5604.

Prohibition of preservatives in milk should be absolute, 5608, and preferred as to butter, but deemed difficult, 5609.

Colouring matter much used in South England butter, some uncoloured in Midlands, 5567. Aniline colour now much used, in very small quantity, 5568-69, not sufficient to harm, 5570. Martius' yellow never detected, 5571. London milk almost invariably coloured, 5572, 5574-75. Deceptive practice, but universal, 5873.

Copper in peas a poison, perhaps not injurious in quantities used, but use fraudulent and should be prohibited, 5628; limit of safety not so easily overstepped as with some poisons, 5629, but copper sulphate has a point where it becomes distinctly poisonous, 5630.

Hill, Dr. Alfred. (Digest of his Evidence.)

Medical Officer of Health and Public Analyst of Birmingham; represents the Incorporated Society of Medical Officers of Health, 2325-27.

Analyses made of various kinds of food, 2330-31. In 1896-99 20 per cent. contained preservatives, 2385.

Milk samples from 1896 to 1899 in 9 per cent. of number contained either boracic acid or formic aldehyde, 2332, 2385, 2461-63. Quantitative analyses made, 2333. Of milk samples in 1896 there were 8·3 per cent. boracised, 2334. Boracic acid decreasingly used, and formic aldehyde increasingly used, 2340, 2383-84. Of milk samples from farmers 2 per cent. contained preservatives, 2341. Milk most frequently preservatised in summer, 2343, 2389-93. Same sample found to contain boracic acid and formic aldehyde, 2381-82. Use of boracic acid may have reference to supply and demand, 2394-96. Preservatised samples most frequently adulterated, 2397-98. Watered milk does not need a preservative more than other milks, 2399, 2400. Old milks naturally would be preservatised, 2401-4, and fraud perpetrated therefore, 2405-8, and danger arise by decomposition, 2409. Lower classes most likely to get preservatised milk, 2450. Incipient harmful changes in milk not perceptible to taste or smell, 2467-69 People will drink milk slightly sour, 2471. "Fresh" milk is milk recently from the cow, 2502-3, and unpreservatised, 2504. Preservative chemicals in milk disapproved of by the Society of Medical Officers of Health, 2522.

Butter samples to 28 per cent. in 1896-99 contained boracic acid; 31 per cent. in March quarter, 23 per cent. from April to September, 2344, 2385; latter by reason of fresh butter being in summer use, 2345-48, and locality of supply, 2472-74. Birmingham summer supply largely local, 2472, and in winter Continental, 2474. Australian butter contains no preservative, 2475-77. It comes in cold store, 2478. "Fresh" butter is unsalted butter, 2507, and may be months old, 2508-11, and customers still be unprejudiced by the title, 2512-14.

Margarine samples to 84 per cent. contained boracic acid, 2349, 2385. Why, not known, 2388. Remainder free from all preservatives, 2350. Often sold as butter, 2351.

Meat foods to 64 per cent. contained boracic acid, from 10 to 45 grains per lb., 2352-53, 2385, 2410-14. Acid mostly was intimately distributed, 2357. Quantity did not vary greatly, 2358. It might be visible, 2359-60. Taste would reveal it, 2361.

Miscellaneous food samples, cream, jam, vinegar, to 33 per cent. contained boracic acid or salicylic acid,

Précis.

2362-63, 2385; 9 samples boracic acid, and 12 salicylic acid. Thick cream, 5 samples; 4 boracised, and 1 salicylised; 3 clotted cream all boracised; of 11 skimmed milk, 1 boracised; of 12 malt vinegar, 1 boracised; of 6 jams, 5 salicylised; of 12 sherry, 1 weak in alcohol, salicylised; of 11 ipecacuanha wine, 5 salicylised, 2364. Latter therefore not pure, 2365; a serious offence, leading in Wolverhampton to prosecution, 2366. No prosecutions in Birmingham on this score, 2425-35. Proportion of salicylic acid not known. Cream contained 24 and 42 grains of boracic acid per lb. Separated milk, 28 grains per gallon; malt vinegar, 14 grains per gallon, 2367. All samples taken in Birmingham, 2369-70.

Ham and bacon boracised by external rubbing or laying on, 2354. Samples examined as retailed, 2355. Boracic acid pervaded the whole ham, but most was outside, 2356-57.

Boracic acid found in 1896 in from 21 to 126 grains per gallon of milk, 2334. Various reasons for differences; carelessness, mixture, addition in solution, and in powder, 2335. Added generally by wholesale purveyor, 2336, farmer, or middleman, 2337. Three separate additions may be made, 2338. Poisoning by the acid not known, 2415. This acid most frequent preservative in foods decomposed and also preservatised, 2436-40. A day's visit to Birmingham might result in more than a maximum Pharmacopœal dose (45 grains) of borax in food consumed, 2456-57, plus a like medicinal dose, 2458-59. Indiscriminate treatment of food with borax hampers the medical profession in the treatment of patients, 2460.

Formic aldehyde present in milk $\frac{1}{100000}$ to $\frac{5}{100000}$. Often believed to be $\frac{2}{100000}$, 2333. A dangerous preservative, 2342, 2418-20, 2443. Never used for butter, 2350, 2439. Stronger than boracic acid; used in smaller amounts, 2386; and more efficacious, 2441-42. Injurious effects not known, 2387, 2416-17.

Benzoic acid or salicylic acid never found in butter, 2351. Poisoning by latter acid not known, 2416-17.

Prohibition of preservatives; no general action taken by Birmingham Town Council, 2328, or to regulate their use, 2329. Prohibition absolute as to milk in New York State, 2452-53; also in Belgium and Austro-Hungary, and parts of Switzerland, 2454. The same feasible for Birmingham, 2455. Boracic acid unnecessary in milk, 2461-66, 2470. Use of preservatives should be prohibited by law, 2499-2500, 2506; use disapproved of by Society of Medical Officers of Health, 2522.

Declaration should be made of addition to, and quantity of preservatives in milk, 2505, and indeed in all foods, 2522.

Cold a better preservative than drugs or minerals 2500-1.

Prosecutions for boracised milk successfully undertaken, 2341. Also as to butter, 2367. Not taken against wholesale dealer, 2368. On ground of injury to health of preservatives, very difficult, 2424-32.

Physiological effects of boracic acid marked and hurtful, even fatal. Use of drug requires regulation, 2339. Inconvenience from use of preservatives in food has arisen on many occasions, 2372. Hearsay instances quoted, 2373, but none known personally, 2423. Injury has followed internal use of the drug, 2421-22. Preservatives prejudicial to digestive processes, 2511, 2515-17. Haphazard administration most dangerous, 2518.

Diarrhœa thought of in relation with boracic acid in milk, 2374, 2448-49. Causal relationship not studied, 2375, 2447, or traced, 2445-46. Investigation would be difficult, 2376. Poor people most liable to diarrhœa, 2377, and to get boracised milk, 2378-80. Several causes of diarrhœa can always be found, 2444. The disease increases in the ratio of poverty, and among the class getting most preservatised milk, 2450-51.

Colouring matters studied a little, 2479-80; preserved vegetables, mostly free from colourings, 2481-82. Those not coppered less green, 2483. Health should not be sacrificed to colourings, 2483. Sulphate of copper injurious colouring agent; a harmless colour should be employed. Pickles not coloured, 2484. Aniline colours used in milk at times, and at one time in spurious Demerara sugar. Also annatto in milk, and possibly turmeric. Chromate of lead not now used, but used to be found in confectionery 2485-86. Confectionery and milk colourings now harmless. Milk in Birmingham vended by one man with yellow coloured water in cart, 2487-88. No proceedings feasible, 2489-91. None taken in Birmingham as to coloured peas, 2492-93. No experience as to legal dealings with injurious colourings, 2494-95. Specified metallic colouring matters prohibited in certain countries, as Belgium and France, 2496, and should be so at home, 2497-98.

Hope, Dr. E. (Digest of his Evidence.)

Medical Officer of Health for Liverpool, 6821.

Preserving of food to be desired and waste prevented, 6822-23. Cold storage and chemical preservatives two known means of preserving food, 6824. Copenhagen system of cold storage, 6824, not applicable here by reason of cost of ice and cost of inauguration, 6825. System failed in Liverpool; doubtless it has had some success in Manchester, 6826. The Copenhagen plan is worked by block ice, 6827.

Preservatives becoming more common in every-day articles of food, 6840. Same objection does not lie as with milk and cream, 6841. Food preservatised may be dirty and contaminated and yet sterile, 6867-69.

Milk kept sweet for some time by a limited application of cold; preservatives seldom found in Liverpool milk samples, 6828. No necessity for chemical preservatives in milk, 6829, 6837, 6839. Vendors say public want them, 6838. This is not so, 6839, 6864. Liverpool milk supply comes from a radius of some 50 miles, 6831-33. Sterility of milk claimed as regards milk rendered sterile by chemical preservatives, a false claim, 6870-75. Milk at Liverpool hospital very frequently analysed, 6884, for preservatives, including nature and amount 6885-87, 6889-90. Milk should contain no preservatives, 6888, 6891, especially in fever hospitals, as digestive processes are thereby interfered with, 6892. Physician should know composition of milk taken by a patient, 6894. He might stultify himself, 6895. Milk supply of large town needs no preservative, 6896, nor refrigeration, 6897.

Cream more commonly preservatised than milk, 6834, and sold both by dairymen and grocers, 6836. Preservatives not necessary, 6835, and not approved by medical authorities, 6837.

Borax dusted over pork coming in large and increasing quantity from America: procedure not deemed objectionable, 6878. Boracising of fish given up, 6915, because flavour was destroyed, 6916. Boracising of oysters not known, 6919. Oysters having 38 grains of boracic acid to the lb. objected to, 6920-21.

Salicylic acid found, 150 grains to a gallon of wine, 6923, some 19 grains per pint, 6924. This would with other such things upset children, 6925, but is not a serious matter of itself, 6927-28. British wines in question, 6926.

Sulphite of sodium in meat heard of, 6913, but not inquired about, 6914.

Formalin heard of as used for fish, 6917, but not inquired about, 6918.

Jam unequally preservatised with salicylic acid; some has none, and some ten times that of others containing the acid, 6843. None necessary, 6844. Manufacturers probably ignorantly reckless, 6845.

Egg powders are baking powders; one such powder is prepared with dried egg, 6853; some are not egg powders at all, yet are used by some persons as food for children, 6854, 6859-62. Some labelled as not made from eggs, 6855, as the result of a prosecution, 6856-58. Powders are coloured to simulate egg-colouring, 6863, 6865-66. Egg powders looked upon by vendors as naturally eggless, 6864.

Indiscriminate and reckless use of preservatives objectionable; 150 grains of salicylic acid found per gallon of British wine, 6842, 6923.

Sterilisation preferred as an alternative to chemical preservatives, 6899. Infantile scurvy never heard of in association with sterilisation, 6900-1. Evidence to the contrary as to sterilised humanised milk, 6902-7.

Harm may accrue to young infants by use of preservatised milk, by way of retarded digestion. Kitten experiments demonstrate harm by boracised and formalised milk, 6830. A case of illness in a child by one day's boracised milk diet, 6841, 6910-12. Very serious harm will result to infants if the "humanised" milk now sold as pure milk is pre servatised, 6879, and this may result despite practicable precautions, 6880-83. Harm looked for if boracic acid administered in scarlet fever and kidney disease, 6893. Harm to infants from preservatives difficult to trace, 6908-9. Relation of preservatives to infantile diarrhœa not traced, 6922.

Declaration of preservative, amount and nature and date of addition should be made in all cases, 6867.

Prohibition of preservatives in milk desired, 6888. Need not dislocate the trade, 6898.

Proceedings have elicited defence that preservatives as used are not a danger to health. Witness disagrees. Another defence has been their use as medicines; but the argument is absurd, and the administration of drugs in such manner is most objectionable, 6846.

Trained inspectors necessary for the obtaining of average samples of food, 6875-77.

Colouring matters sometimes ornamental and harmless. Commonest used for sausages described, 6847-48. "Smokene" also described, 6849. Use fraudulent, 6849-51. Glucose and treacle sold as syrup also fraudulent, and burnt sugar and dilute acetic acid when sold as vinegar, 6851. Latter not injurious. Colouring matters conceal staleness, inferiority, and dirt, 6852. Colourings of "egg-powders" fraudulent, 6863, 6866.

Copper not uncommon in bottled peas, fruits, and vegetables; ½ grain to a lb. deemed by trade necessary to green the peas, 6929. Copper as found in peas held to be soluble in human economy, 6930, on eminent hearsay evidence, 6931. Uneasiness and indigestion have resulted from coppered peas, 6932.

Hudson, Mr. James. (Digest of his Evidence.)

(Appears on behalf of the Butter Association.)

Chairman of Messrs. Hudson Brothers, provision merchants, 489-90.

Butter trade has seen many changes during last 50 years, 492; all butter heavily salted years back, especially Irish butter; such butter not now saleable, and no necessity for it since preservatives came into use, 493-94. Any overstock of butter is cold-stored, and never spoils, 548. Cold storage in vogue for past five years, 553. Factories consign the butter to London, 495, with added preservatives, 496.

Colonial, Irish, and Normandy butter principally dealt with; no complaints of Normandy butter, 501-2. New Zealand butter from cold storage quite fresh and sweet, 504. Canadian butter has been kept three months, 549-50, when preservatives in use, 551. No complaints of butter turning off as formerly, 551-52.

Danish butter but little traded in of late, 502; it does not keep as well as Colonial or Normandy or Irish butter, 503-4; sale probably decreasing, 538; has not sold it for two years, 539-40; good firms use Colonial and Irish butter in its place during winter, 541.

Irish butter trade increasing, 538; has increased 200 per cent. during recent years, 542-44.

Bacon and ham smoked on arrival in green state, and any preservatives washed off, 506-8.

Preservatives not added to butter by Hudson Brothers, 492, 546; one half per cent. put in by factories sufficient, 492, and never exceeded, 499; butter so treated used for years, 500; one per cent. or over could be detected, 497, by the flat taste, 498, spoiling the flavour of the butter, 500. Butter taken out of cold store would turn at once if no preservative had been used, 555. Preservatives but little used in English bacon and ham, but used in American products, 505. Their use tends to increased consumption of produce, 517-18.

Prohibition of preservatives would affect both producer and consumer, 501; and injure the Irish and foreign trade, 504. Prohibition by France of American bacon and ham wherewith preservatives had been used, carried out and also withdrawn in 1899, 505, 523. Prohibition would stop the sale of cream, 515, and of Irish butter, 538.

Boracic acid, of one quarter per cent., in cream will keep it some four to six days, 515, 526-30; useful for keeping fresh meat and game, by sprinkling, 518-19, and does not penetrate, 520.

France strict as to use of preservatives and colourings, 521-22.

Proceedings against Hudson Brothers on account of boracic acid in cream, 509-11; 16 grains to the ½ lb., or about one quarter per cent., 512-13.

Cream unpreservatised will not keep a day in summer, 515; more than one half per cent. of boracic acid unnecessary, 526-27.

Colouring matter used in butter in winter only, 531; used in cheese unnecessarily, save to meet public demand, 533; annatto said to be thus used, 534-36.

Saltpetre used for colouring bacon and hams, 508.

Hutchison, Dr. Robert. (Digest of his Evidence.)

Assistant Physician at the London Hospital, and represents Great Ormond Street Hospital, 6691-92.

Boracic acid taken by witness, 20 grains a day, for a fortnight continuously on full stomach produced no observed ill effects at all, 6693-94, 6696-97. If witness has a weak spot it is his stomach, 6695. Also 5-grain doses twice daily of borax and boracic acid solution, 2½ grains of each, for the same period had no ill results, 6698-6700, 6712. Inference that boracic acid and borax as used in milk consumed by an adult would be harmless to an average healthy man, 6701. Boracic acid excreted by the kidneys, 6706. Would not like to take 80 grains as a dose, 6713, even with a pint of milk, 6714.

Formalin pretty largely used, 6740. A local irritant, 6741. Small quantity only required to preserve milk, 6742.

Benzoic acid irritating when swallowed, 6743, in 5 to 10-grain doses, 6744, on an empty stomach, 6745, in single doses daily, 6746. Frequently prescribed for septic conditions of urine, 6747. No local stomachic irritation noticed when it was prescribed, 6748.

Contra-indication of borax in kidney disease not a matter on which would like to express an opinion, 6705. Effect on diseased kidney thought of as small, 6707. No information on the point, 6708. No specific effect in pregnancy known, 6709-11.

Contra-indication of salicylic acid in cardiac affections, 6737, and perhaps in acute nephritis, 6738 Probably dangerous in acute forms only of kidney disease, 6739.

Harmful results of continued use of borax or boracic acid read of, 6702. No bad effects noticed when borax used for short period for epilepsy, 6703. It was mixed with bromide; not known which did the good, 6704. Might be dangerous to children to take 30 grains daily in milk, 6715-16. Would not like to administer 80 grains of boracic acid in a pint of milk, but could not say it would produce ill results on gastric cells, 6753-54. Leibreich's experiments known as to borax, boracic acid, and formalin, 6755, showing surprisingly little local effect on lower animals, 6756, adult dogs chiefly, 6757, and inference on puppies cannot be inferred therefrom, 6758.

Preservatives not thought of as likely to veil decomposition in milk, 6717-18. Preservatives are of use in the interests of public health, 6719, 6768. Less harmful than sour milk, 6720-21, or bad food, 6749-50, especially milk, 6751-52. Indiscriminate use should be remedied, 6722, 6749. Standardising of preservatives desired, 6723. Moderate use of preservatives to be thought of as lessening risk of diarrhœa by bad milk, 6769. Diarrhœa not attributed to boracic acid in milk, 6770, rather to lack of sufficient preservative to keep milk from going bad, 6771. All diarrhœa in children not due to bad milk, 6772-73. Diarrhœa should be decreasing by use of preservatives, 6782. Not known if it be so, 6783.

Idiosyncrasy probably not of much account *quâ* preservatives, 6749-50.

Medical profession do not regard preservatives in food seriously, 6727, nor do the hospitals, 6728. Physician's practice not stultified by preservatised milk, 6729, unless boracic acid were both prescribed and also in the patient's milk, 6730, as also with salicylic acid, 6731. Medical profession affected in this sense, 6732-35. The uncontrolled use of preservatives would be a bad thing from medical men's point of view, 6736.

Milk ideally should be sterilised or pasteurised and unpreservatised, 6723, 6760. Sterilised milk has advantages for children, 6724-25. Pasteurisation would be of great good as a germicide, 6726. But borax or boracic acid, or both mixed in quantity

Précis.

just sufficing to preserve milk would probably be harmless to the majority of people up to four or five pints daily, 6759. Storage of unpreservatised milk in the houses of the poor may lead to its going bad before consumption, 6761, 6763-66. Exceedingly difficult to get poorer class to properly house milk, 6762. Uncleanliness of dairies arising from use of preservatives should be met by inspection, 6767. Hospitals get milk from good companies, 6774, and some have analyses made from time to time, 6775. Details of milk contracts not known to hospital medical staff, 6776-79. There can be no objection to contracts, 6780, and reasonable to exclude preservatives in the contracts, 6781.

JONES, DR. J. HOWARD. (Digest of his evidence.)

Medical Officer of Health of Newport (Mon.) County Borough, 1307.

Butter can be shipped for long distances without the aid of preservatives, 1309, as from Australia and Denmark, 1315, 1339-41. Samples found to contain 0·71, 0·74, and 1·3 per cent. of boracic acid, 1309. Limits of use of boracic acid in butter not determined, 1310, 1312, 1385. Such percentage as that last named would probably result in proceedings being taken, 1311, as it did successfully at Pontypool, 1320. Percentage considered by bench to be injurious to health, 1321. It was over 90 grains per lb., 1322. Butter now consumed quickly, 1342-43, local butter within a week, 1344-46. Preservatives unnecessary, 1361. Has known rancid butter to contain a preservative, 1363-64, 1378-84. Newport butter supply is local, and Irish, and Danish, 1400.

Milk can be kept sweet long enough for distribution without preservatives, 1309. Newport's milk supply local, 1399. The presence of preservatives would be an occasion for proceedings, 1405, formalin being excepted on account of likelihood of losing the case, 1408-11.

Boracic acid objected to altogether in milk, and unknown to consumer in other articles of food, 1313. No experience of ill-effects, 1314, 1316. Case of alleged ill-effects in person of a delicate lady, 1317-19, 1323-27, 1349-60, 1386-90. Boracic acid poisoning produces diarrhœa and vomiting, 1332; low temperature, 1333-35; and may much resemble chronic ptomaine poisoning, 1336; boracic acid would retard commenced decomposition in milk, 1366-68, 1374-75; and might prevent it being detected, 1369; but would not mask decomposed milk, 1370-73; but 1 in 30 would wholly retard decomposition, 1376-77. Newport pork butchers used to use 4 ozs. of borax preservative to 40 lbs. of meat, 1395-97; preparation called Glacialine, 1398.

Preservatives a source of unnecessary danger in milk, especially to infants and invalids, and a direct encouragement to neglect of measures of cleanliness, 1309, 1362, 1365; prohibited in milk and in appreciable quantity in butter, creams, prepared meats, and other articles of food under pain of penalty, in Newport (Mon.), 1309; great reduction in sale of boracic acid followed, 1391, 1395; and other forms of preservatives grew in demand, 1392-94; "Schering's Formalin Solution" being widely advertised, 1393.

Putrefaction in food known to cause illness, 1328; symptoms unlike those of boracic acid poisoning, 1329-30; save when chronic ptomaine poisoning occurs, 1336.

Food sampling in Newport not large, 100 samples per annum, 1401-4, 1406.

Colouring matters not troubled about, 1407.

KAYE, DR. JAS. ROBERT. (Digest of his Evidence.)

M.D., D.P.H., Medical Officer of Health of West Riding of Yorkshire, Fellow of the Chemical Society, &c., 5432-36, 5464.

Preservatives in milk and butter recently and specially studied as regards West Riding, with a population of over one million persons, 5437-42, and investigation to be continued, 5496. No proceedings taken, 5443, by reason of appointment of present Committee, 5463. Preservatives increasingly in use and found in milk, meat, and tripe, 5444 A list of five preservatives and data concerning their use were handed in, 5455 (App. No. 30). All compounds of borax and boracic acid, or pure boracic acid, 5456-57. Preservatives recklessly used by dredgers; cow carcases known to be dredged all over, 5462. Preservatives fairly generally used throughout the country, but less among co-operative societies doing a quick trade, 5473. Use of preservatives known as general during past seven years, 54 2 Present knowledge of extent of use not very great 5495, but hope held of further information resulting from prolonged inquiry, especially as to seasonal use, 5496-97.

Boracic acid as a preservative deleterious, 5502. Dangerous to take 54 grains, 5506. Presumptive evidence obtains as to prejudicial effects of the acid, 5513.

Mortality of infants in third quarter of the year put down in part to large use of preservatised milk during the hot months, 5466-72. Infantile diarrhœa mortality always excessive in third quarter, 5474-76, 5481, and preservatised milk thought of as a factor in preventing fall in such third quarter mortality, 5477-78, 5484, but some improvement to be looked for as regards towns purveying unpreservatised milk if thesis be true, 5485-88, but some cause operating prior to use of preservatives, 5482-83, and perhaps decomposed milk, 5484, 5492. Diarrhœa may be produced by changes in milk, resulting from contained preservatives, 5493-94. Tinned milks not regarded as a prime factor, 5535-37, but they play their part, 5538-42. Diarrhœa caused by borax administered as a drug to children, 5503-4. Dosage not known, 5505. Conditions surrounding child-life tend to diarrhœa, specially in the third quarter, 5543-46. Boracic acid a greater cause than tabes mesenterica, 5553-56. Diarrhœa mortality-curves of Continental cities vending unpreservatised milk tend to show lower infantile rate, 5557-58.

Infants and invalids should not be subjected to indiscriminate use of preservatives in food, 5509-12. Actual evidence of harm is not great; but there is such, and certainly presumptive evidence as to boracic acid, 5513.

Physiological experiments point to injurious effects of preservatives, 5514-15, especially as to formalin, 5516-17. Preservatives to be effective must injuriously affect human delicate digestive organs, 5518, 5547-52. Boracic acid as a drug, and as a preservative daily in use, very different, 5552.

Milk largely treated with boracic acid or formalin in summer but free in winter, 5444-46; the same true of preservatives generally, 5489. Vendors declare preservatives to be necessary, 5447. Preservatives unnecessary in dairy produce, 5448-50, 5519, and undesirable, 5451, and a cloak for dirt, 5519-20. Adulterated milk most preservatised, 5458, and poor most likely to get such milk, 5490. Has found 20 grains of boracic acid in a sample of milk, 5459-61; probably the result of repeated dosage, 5462. Stale milk sold by aid of preservatives, 5498-5501. Suckling declining in West Riding, 5527. Use of tinned milk increasing, 5528-30, and used all year round, 5533-34, but general absence of preservatives therefrom not known, though not held improbable, 5531-32.

Cooling of milk increasing in West Riding, 5521-23. All farms should have proper water supply, 5524-26.

Order as to Dairies, Cowsheds, &c., indifferently enforced, 5452. Preservatives abet evasion of regulations, 5453-54. Insanitary conditions affect milk, 5479-80.

Cleanliness at a discount by use of preservatives, 5454. Dirt cloaked thereby, 5519-20.

Refrigeration, sterilisation, and pasteurisation on different footing to preservatives in milk, 5499-5502. Recommends sterilisation of milk, 5559. Doubts its indigestibility, 5560. Growing in use in Ripon, 5561.

Butter preservatised with 0·77 per cent. of boracic acid. Adulterated butters most frequently preservatised, 5458. Daily dosage of boracic acid in butter not likely to be large, 5507-8.

KELLITT, MR. JOHN. (Digest of his evidence.)

Appears on behalf of the Grocers' Federation, a body of 13,000 members, 1-2.

Has found no opposition to the use of borax as a preservative, 7; does not know the difference between borax and boracic acid, 10, 25; borax used with bacon packed in boxes, and dusted on bacon to prevent fly-blow and absorb moisture, 11, 12, 23; borax thus used for last 20-25 years, 13-14; bacon thus treated in increasing quantity, in place of

Précis.

very salty American bacon, 15, 29, 33-35. Bacon, formerly cured in America and packed in salt; salt could not be extracted even by steeping; complaints arose as to excessive saltness; bacon now cured, and salt washed off, and borax dusted over it, 15; saltness thus reduced and slimy condition obviated, 15, 73-74; bacon still cured with salt and saltpetre, 16. Borax does not cure, 17, 20; nor saturate the meat, and penetrates very slightly if at all, 17-18, 36-38; bacon of to-day better alike for dealer and consumer than ever before, 19. Irish and Danish cured bacon was formerly too salty, especially in the "pocket"; shoulders formerly nearly unsaleable; this now altered, 21, 65-67; people will not now eat salty meat, 29, 31.

Borax used in the form of boron, a preparation of a nature drier than borax, and a quicker absorbent of moisture, 24; boracic acid not a trade term, 25.

No other form of treatment of hams than by dusting and packing with borax known; some American hams are pickled, but nature of pickle not known, 26; no suspicion of any preservative thus being used, 26-28.

Prohibition of borax preparations in ham would be serious in the absence of other equally good preservatives, 30; people will not eat salty meat, 31; one result would be that the trade would try and cure bacon that would not keep in Ireland, 32.

Tainted bacon much less frequent since preservative used, and no market now for such meat, as formerly, 39; fly-blown bacon, which used to cause loss in summer, rarely seen now; fly-blow only seen where meat is moist, 41; tainted bacon once marketable and in demand, 52; tainted bacon is bacon not sweet, 53; and was obtainable at cheaper rate, 54; but was preferred even apart from price, 55.

American hams kept in boxes with borax from three to six weeks, 57, 59, 63; borax washed off only in retailers' hands, 58, 62, and a great deal of the meat then sold within a week, 60.

Borax put on hams in process of packing, 61.

Bacon cured before borax is used; bacon hung up and dried after borax washed off; boron used generally in summer on this hung bacon, 64.

Irish and Danish bacon sprinkled with borax only on the shoulder portion; sides do not need sprinkling owing to short voyage, 68-69; hams generally cured with the sides, 70; no preservative detected on Danish hams, and but little if any used, 69-72.

Irish bacon cured like Danish 20 to 30 years ago; but borax now used to prevent slimy condition of meat, 73-74. Danish method an improvement on Irish mode of curing, 75.

Butter heavily salted not now saleable. Salt in excess in butter just as injurious as borax; borax in excess would impart an unpleasant flavour to butter, 43.

Butter chiefly from Denmark, and secondary qualities from Ireland, 44; witness has never bought Colonial butter, 49.

Danish butter remarkably good, and keeps better than English butter, 45-47. Witness not aware that any preservatives are used in it, 45, 49.

Use of preservatives in butter not within knowledge of witness, 50.

Provisions now used generally in a fresh state, 56.

LONG, MR. JAMES. (Digest of his Evidence.)

Professor of Dairying, Member of the Central Chamber of Agriculture, which he represents, 4565-69.

Preservatives not needed for dairy traffic, 4571, 4677-78. Used promiscuously, and 56 grains per gallon known, 4579, and also $\frac{1}{20}$th of oz. per gallon, 4580-81.

Milk trade does not call for preservatives, 4570 74. Separators introduced in some parts of Devonshire, 4594. Milk repeatedly preservatised, 4604-11, though this is denied, 4612. Milk sent to London by witness from Hampshire and Hertfordshire, 4611-13.

Keeping quality of milk depends on many phases of cleanliness, 4588.

Cooling of milk well enables it to be kept 24 to 36 hours in hottest weather, 4577, that is, cooled below 60° F., 4578. Milk kept at 60° F. for first 12 hours will keep 36 hours in all in hottest weather, 4582-84. Milk cooled from 55° to 60° F. kept 36 to 48 hours, being scalded in sultry weather, 4588 93. Imperfect cooling has led to return of milk to witness, 4611.

Cleanliness essential to the keeping of milk, 4578. Four ounces of slime taken by heavy milk drinker per annum, 4579, 4691-95. Dirt masked by preservatives, 4671, 4695, which put a premium on good dairying, 4677.

Pasteurisation of all milk effected by one large dealer, 4585-88.

Sterilisation practised by witness, 4594; on small scale, 4599, but in places on a very large scale, 4600; process described, 4595-98. Bottle cleansing is a trouble, 4601. Bottled milk used in Switzerland, 4602. Milk cannot be tampered with in transit, 4603, and delivery is less frequently needed, 4604. Cleansing of bottles more difficult than of cans, 4697-4701, unless daily service in question, 4702. Bottling of milk on a large scale need not raise the price, 4707-9.

Butter from Denmark unpreservatised fetches a higher price than preservatised French butter, 4629-42, 4672-76. Slightly salted butter is "fresh" butter in the market, 4642. Moisture in Irish butter same as in good butter, 4644. Factory and creamery butter not discriminated, 4645-57. Using Danish methods, Ireland could turn out equally good butter. People do not want preservatised butter, 4658. Tuberculosis has nothing to do with Danish dairying system, 4670-71. Preservatised butter insipid, 4671.

Keeping power of well-made butter without preservatives keeps it for six weeks, 4642. Neither pasture nor manufacture held to render Irish butter inferior to Danish in keeping power, 4644. Danish butter is from milk practically sterilised, and then re-inoculated by flavour germs, tending to keep it sweet, 4667.

Flavour of Danish butter not lost by pasteurisation, but not so fine as English prime butter, 4668, and cannot be made so fine, 4669.

Inspection of farms made in Denmark, 4665-67.

Bacon in Ireland not preservatised, 4658. Restriction on use of borax packing would hamper Transatlantic trade, 4659, unless cold chambers used, 4660.

Fruit preserved in bottles without any preservative, 4663, but colour goes off somewhat, 4664.

Boracic acid objected to in food, 4661-63.

Injurious effects of preservatives on digestion inferred, 4579. Salicylic acid held to arrest peptic digestion, and heavily boracised milk, 210 grains per gallon, to be injurious to a milk drinker, 4613, 4696. Illness alleged to be caused by preservatised milk, 4615-26. Preservative drugs in food objected to, 4627. Good deal of injury by preservatised food suspected, 4628.

Prohibition of preservatives in milk would not restrict supply, 4572. Prohibition of preservatives should be enforced as regards substances, the effect of which upon infants and invalids is not known, 4689. The effect should be determined prior to use, 4703-6.

Declaration of articles as preservatised should be made, if preservatives allowed, 4689.

Restriction to one preservative material and to a limited quantity should be enforced on vendors, and use allowed only in three hot months of the year, 4689.

Colouring matter used in some cheeses, and in butter. Breed of cattle affects and effects colouring of butter. Annatto is harmless. Some colours, as aniline yellow and methyl orange, produce undesirable symptoms, 4684. Colouring should be prohibited in dairy produce, 4685, and but little hurt to trade would result, 4686. Colour in cheese merely a question of public fancy, 4687-88.

LOUGH, MR. ARTHUR S. (Digest of his Evidence.)

Member of the Irish Agricultural Organisation Society, and Managing Director of the Cavan Creameries, Limited, 6614-17.

Creamery industry revolutionised of late years in Ireland, 6618, and very largely increased, 6619-20. Nearly all the creameries use preservatives in summer, 6621. Only butter made, 6622. Farmer waits for the separated milk, 6623, for feeding calves, 6624. Cleanliness is observed at the creameries as to milkers, cattle, utensils, storage of milk, and so on, 6677. Straining is insisted on, 6680.

Factory butter not touched at creameries, 6642. A source of annoyance to creameries, and often sold as creamery butter, 6643. It is not creamery butter, 6644. It is different from, 6645, and inferior to

Précis.

creamery butter, 6646. Irish and Normandy factory butters of very different class, greatly in favour of the latter, 6647.

Preservatives not essential to creamery industry. They are asked for, but less quantity than used would suffice. No complaints made of use of preservatives, 6625. Preservatives needed because butter required to keep. If used fresh, need for preservatives would be less, 6626. Preservatives should not be requisite for butter from field-drawn milk, 6629. Conditions of housing of cattle in Ireland more favourable to prohibition of preservatives than in Denmark, 6656-58. Use of preservatives deprecated in agricultural products, 6659. They would be quite unnecessary in a few years in creameries with proper organisation, 6660. Presumably preservatives in butter would be harmful, 6668. They should be done away with, and are being got rid of in witness's creameries, 6676. Borax chiefly used, 6681.

Restriction rather than declaration of preservatives advocated, pending prohibition, 6662; latter might handicap the trade, 6662-63. Would like to know if he were taking a harmful preservative, 6669-72. Consumer has a right to know, 6673-75, but not as to butter only, 6675.

Prohibition of preservatives would be a hardship on some butter-makers for a long time, 6661, 6683-84. Harmful preservatives should not be used, 6664-67.

Pasteurisation more needed in winter in North than in South Ireland, because of the winter stall feeding of cattle, 6627. Denmark needs pasteurisation for same reason, 6627-28, and to erase feed taint, but butter from field-drawn milk needs no pasteurising, 6629-30. Pasteurisation held to be most valuable, 6631-32. Temperature in pasteurising some 175° to 185° F., 6633. Improvement of milk of house-fed cattle by ferments or cultures not known, 6634-36. Practical difficulties in dealing with large quantities of milk are being overcome, 6690.

Keeping power of butter greater when both pasteurised and preservatised, 6682. Salt must be used if butter be kept some time, 6685-86.

Cream has been sold without any preservative, 6688-89.

Transit of butter in Ireland the curse of the trade, 6637, 6639. Redress hoped for at the hand of the new Agricultural Board, 6638. No traders' rolling stock in Ireland, 6640. Procedure for compensation very unsatisfactory, 6641. Matters in Ireland worse than in Denmark, 6687.

Cattle housed in Denmark eight or nine months a year, 6654-56, in Ireland from four to six months, 6657.

Water supply to farms not looked to, 6678, but supply is good in North Ireland, 6679.

Colouring matter hardly ever used in creameries, 6648. Some dairies use annatto in very small quantities, 6649. Winter butter nearly same colour as summer butter, 6649-50, 6652, with mixed breeds of cattle, 6651; no Channel Islands cattle in question, 6652. An error in scalding may render annatto necessary, 6652. No great difficulty as to colour, 6653.

Lovell, Mr. John Cary. (Digest of his Evidence.)

(Appears on behalf of the Butter Association.)

Butter trade, experience of, since 1852, 706; in a large way, 707. Trade has greatly developed of late, 708, 710; preservatives have conduced to this, 709, 711; fresh and unsalted butter now demanded, 710. Nearly all butter now treated with preservatives, 716. Dry butters keep best, 769. Continental butter on consumers' tables three days after manufacture, 793-95. If it keep a week the purpose of trade will be served, 796-99, 805. But it must be kept in a cool place, 800. Butter cannot be treated so as to keep more than a week, 804.

American butter was spoiled in transit prior to use of preservatives, 712.

Normandy salted butter, only, imported 40 years back, 713. Goes into consumption at once on arrival, 801-2. Is on consumers' tables three days after manufacture, 725, 793-95. As now imported it keeps better than Danish butter, 726. A finer article than Danish, 730. It contains one half per cent. of preservative, 762-63.

Irish butter of relatively weak quality, 737, on account of food, 738, 772, and wet weather, 739-40, and pastures, 772. It now comes fresh, and has greatly improved, 741-44. Some made still on old modes, but preservatives enable it also to be successfully placed on the market, 747. Made principally in small quantities, hence cannot successfully compete with Danish trade, 750. Danish methods would not help without preservatives, 766. Has much more moisture than Danish butter, 767, affecting its keeping quality, 768-69. Could not be got as dry as Danish butter; has an average of 13½ to 15 per cent. of water, 770.

Belgian butter will not keep well, 766.

Danish butter treated with preservatives; fresh butter not imported from Denmark, 717, 771; preservatives not used at first; the butter does not keep like Normandy butter, 718. A great deal of it pasteurised, 727; butter not so fine in consequence, 729. Danish butter superseded on this account, 730. Made on a scientific basis and in bulk, hence competes successfully with Irish trade, 750-51. One half per cent. of preservative insisted on where possible, 752-53. Danish butter very solid, 773.

Argentine refrigerated butter almost waterless, commands high price, and keeps well, 773. Contains not quite half per cent. of preservatives, 774.

New Zealand butter with ½ per cent. of preservative retains full flavour in cold store for nine months, 727. A finer winter article than Danish, 730. Without preservative one-half would spoil, 776, by reason of process preceding refrigeration, and liability to spoil after it has left cold store, 778-81. It is cold stored on arrival, 802.

Scandinavian butter sometimes contains preservatives, 752-54. No Swedish or Norwegian law known against such use, 755-56, 758. Very little Norwegian butter exported yet, 756-57. More comes from Finland, 757.

Margarine preserved with borax and boracic acid, 806.

Preservatives have largely superseded salt, 714. Borax and boracic acid only used, 715; these, and these alone answer all purposes. Tasteless in small quantity, 806. Only minimum requisite amounts used, 718, 737. Only used as an essential, 749. One-half per cent. impressed on consignors, 719, 720. It is regarded as the necessary minimum, 790-92. It suffices to keep butter three or four days, 725, 783, 793. Necessary to Irish butter trade, 737, 747. Brazilian Government objected to preservatives in tinned butter in 1891, 720. Legislative prohibition of undue use of preservatives advocated, 722, 724. Large amounts kill bad flavour and partial decomposition of butter; over 1 per cent. detectable, 723, 783-89. Has found 2½ per cent. in butter, 787. Butters repeatedly analysed as to quantity of preservative used, 775. Preservatives used for all imported butters, 782. Will only keep butters a week at most, 803-4. In solution on wrappers will not suffice to keep butter, 807; used thus simply to prevent injury to butter from wrapper dressing, 808. Personal and family use of boracised butter, and milk, large and continuous, 809-15.

Prohibition of preservatives would stop Irish butter trade, 737, 765, and injure the butter trade generally, 764.

Pasteurisation of butter destroys its fine flavour, and the keeping qualities of frozen butter, 727. Given up by Colonies and the Argentine, 728. A fad of the Danes and very expensive, 730-31. Milk raised to 170 deg. F. and then separated, destroying fine flavour of cream, 732-33.

Formalin held to be injurious, 806.

Weather affects the texture of butter, 739, 772, and its keeping quality, 740.

Colouring of butter and cheese needed only to satisfy the varying local public demands, 734-37.

Lowe, Mr. W. F.

Public Analyst for Chester City, Carnarvonshire, &c., 3295. Witness deaf, 3297.

Has prepared a memorandum stating his views on use of preservatives in food, 3296, which he handed in, 3297. (Appendix No. 16).

McCracken, Mr. Robert. (Digest of his Evidence.)

Managing Director of Dunragit United Creameries 2849-51.

Preservatives long used at Dunragit Creameries, 2852, in milk, cream, and margarine, 2853, but not in butter, 2854.

Boracic compounds used as preservatives, 2856, borax and boracic acid and compounds, used, 3007-9.

Milk preservative added to a little milk and then mixed with bulk, 2862, and intimately distributed, 2863, but only in summer, and ½ to 1 oz. to 16 gallons, 2878-79. Milk could not be carried to a distance without a preservative, 2869. Cooling milk will aid its keeping quality, but not long in hot weather, 2870-71. Milk formerly not sent long distances. Some now comes to London from Scotland, 2872, and is delivered a day old, 2873, and then goes to consumer, 2874. From 10,000 to 15,000 gallons of milk per diem reach the Dunragit Creameries from four to five thousand cows, 2875. Milk not preservatised by farmers, 2876, 2925, under a stipulation, 2877, 2926, but milk not tested, 2927. No complaints of preservatised milk, 2880, and no proceedings taken against the Creameries, 2881. Milk not sterilised, 2894. Does not like it; has pasteurised some, 2895-96, but only experimentally, 2899, it flavours the milk, 2900, objectionably, 2901. Milk raised to 160° or 170° F., 2902. Cost not known. Only skim milk sent out, all pasteurised, 2903-5; skim milk changes just as quickly as new milk, 2906. Price of skim milk would not pay for sterilising, 2907. Price has not affected question of sterilisation,2908. Skim milk goes into the cities, 2909, as separated milk in winter; in summer it is made into cheese, 2910. Carriage to London spoils the skim milk, 2911, by reason of cost, 2912. Havant Dairy Factory not known, 2913-17. Continental milk trade not known, 2918-19, 2921. Circumstances may differ from Scotland, 2920. Aylesbury Dairy Company's procedure not known, 2922. Refrigeration assists keeping quality of milk, 2923. Many farms have no water supply for cooling milk, such as would render use of preservatives less needful, 2924. Preservatives need not exceed 30 grains or so per gallon, 2928. Milk sent out daily; some may at times be 24 to 28 hours old on despatch, 2933-36. Preservative added systematically to each can as ready to go out, 2937.

Cream preservative added mixed in a little milk and well stirred in, 2864, 2868. Some cream sent in jars, some in bulk, 2865, in differing quantities, 2866, all preservatised, 2867. Cream would not keep well without a preservative, 2869.

Butter sent out fresh, saltless, 2854, and consumed quickly, 2855. Butter intended to keep must be preservatised, 2858. Danish butter contains a little salt, 2859-60, it is called "fresh" in England. "Fresh" butter in Scotland is quite saltless and unpreservatised, 2861. Scottish butter used day by day. Irish butter does not keep very well, 2938-39, it is occasionally used, 2940. Demand irregular, 2941-43. Western Ireland butter takes three days to get on Scotch market, 2942. To London an extra day would be taken up, 2944-45. Butter carefully made and quickly consumed needs no preservative, 2946. Great variety in factory and creamery butter, 2947, due to handling and manufacture and method of supply of milk, 2948. Defective water-supply also a factor, 2950. Percentage of water in good Scotch butter unknown, 2994. Less than Irish butter, 2995, dry as Danish butter, 2996. "Mixtures" not made at Dunragit, 2997.

Salty butter in less favour than formerly, 2857. Butter must now be absolutely fresh, 2951. Danish butter with 1 per cent. of salt does not compete with "fresh" butter, 2952-53.

Pasture does not affect keeping quality of butter, 2949.

Margarine trade of to-day necessitates use of preservatives, 2857. Keeping quality not known to be inferior to butter, 2858. Preservatives keep margarine longer, 2882, 2884. A month or six weeks, 2991, and longer than fresh butter, 2992, as long as salt butter, 2993. Salt also added; absolutely fresh margarine not known to be consumed, 2883. Contained milk makes the margarine "go off," 2885-86. Added to flavour it, 2888-90. Dutch method of milkless manufacture without preservatives not known, 2891-93. Preservatives needed about ½ per cent, 2929. No objection would be taken thereto, 2930.

Formaldehyde in milk used in a few samples, 2932.

Declaration of preservatives should be made if proved to be injurious, 3005-6.

Colouring universal in dairy products, 2954, but not in great variety, 2955. Chiefly annatto, 2956-57. Aniline colours no doubt used, 2958-59. Nature unknown, 2976-77, 2981-82, 2985-90, 3000-1. Yellows used in harmless quantities, 2978, from the Continent, 2979, from Germany or Holland, 2998-99; a Dutch maker vends them, 2999, names not known, 2980. Aniline and annatto mixed, used, 2983, but constituents not known, 2984. Uniformity of colour desired, 2960. Prohibition would close some markets to Scotland for cheeses, 2961. Others will not take coloured cheeses, 2962. Margarine coloured for like reasons, 2963-64, and to resemble butter, 2965. Declaration of colour would make no difference, 2966-67, 2970, only harass the trader, 3004, but all trades should be treated in same way, 2968, 2971-72. Everybody knows cheeses are coloured, 2969. Poisonous colours should be declared, 2973-74. People would avoid knowingly eating coppered peas, 2975. Martius' yellow unknown, 3002-3.

Restriction needed of quantity of preservatives to be used, 2931.

McFadyean, Prof. J. (Digest of his evidence.)

Principal and Dean of the Royal Veterinary College 1751.

Milk should contain no preservative; it is unnecessary undesirable, and, as a rule, physiologically indefensible. If used in useful quantity, a preservative might be distinctly injurious, 1752. Children on milk diet would suffer. Pure milk contains no germs essential to fermentation. Preservatives predispose to lack of sanitary precautions, and of care to eliminate dirt from milk, 1753. No knowledge of extent or quantity of preservatives used, 1754; himself gets the best milk available, 1755. Milk is a good ground for bacterial growth, 1761. Boracic acid would lose its germ restraining effect if the preservatised milk were diluted, 1772. Prohibition of boracic acid in milk would not raise its price, 1773; nor render it more difficult to attain fresh appearance and taste of milk. If milk and butter brought a better price, more land would revert to dairying purposes, 1774.

Butter should only, for physiological reasons, have salt added as a preservative; other preservatives unnecessary, 1756, 1758; though all samples will go wrong without them, 1762. Volatile agents would not be inhibited by preservatives, 1757; which are physiologically indefensible, 1758. Heavily-salted butter not now pleasing to the public taste, 1760. Irish creameries may not be so clean as in Denmark, and thus affect the keeping quality of butter, 1762-63. Butter to keep some two or three months would meet trade requirements, 1788-89.

Declaration simply of butter as preservatised would not suffice, 1759.

Preservatives, apart from salt, objectionable and foreign to the body, 1756, 1778-81. Boracic acid held to be detrimental to health, 1764-65. No specific case known, 1766. Boracic acid does not remove signs of putrefaction, 1767. No physiological manifestations in an adult would follow a dose of 30 grains, 1768, but if continued daily for months such doses could not fail to have effect, 1770. Long experimentation would determine the results of the effects produced, 1796-97. Non-observed results might none the less be injurious, 1798-99. A child might take an enormous dose in its milk, 1769. Form of excretion of the acid not known, 1771. It is a feeble germicide, but restrains the growth of germs, 1772. Its injurious qualities inferentially presumed, 1775. Not known to be non-injurious, 1802, and hence objectionable, 1815-16. A preservative to be of use must be of a strength to restrain bacterial growth, 1782, and might then be distinctly injurious, 1752. Time not a factor in its use, 1783-86, though time is an important trade factor, 1787. Formalin strongly objected to, 1792-95, 1806, as opposed to life, 1807, 1810. Boron in boracic acid is what is objected to, 1804. Poisonous substances might not affect higher and lower forms of life in the same degree 1808, but the exceptions are rare, 1809.

Salt is a food, and enters into the composition of the human body, 1776; is a feeble preservative, less so than boracic acid, 1777.

Sugar defensible in fruits, 1776.

Pasture does not affect butter, 1761; food might affect its texture, but not its keeping quality, 1762.

Pepper not foreign to the animal body, 1800.

Strychnine not to be used as a preservative, 1801, because known to be injurious, 1802.

Précis.

Mann, Dr. John Dixon (Digest of his Evidence.)

Professor of Forensic Medicine and Toxicology, Hospital Physician, &c., 2601-2.

Preservatives: some undoubtedly injurious in themselves, 2604, salicylic acid being one; some probably injurious, 2604; some retard or prevent digestion; and as added to foods preservatives do not sterilise food, 2605. Experiments as to injurious results of preservatives in foods must, to be conclusive, be long continued, as in the case of water-borne lead poisoning, 2611. Preservatives inhibit the action of enzymes, 2617-19.

Boracic acid injurious in cases of external and internal use; cases quoted, 2607. More frequently used in milk than formaldehyde, 2608-10. Not to be compared with salt as a preservative, salt being a natural constituent of the human body, 2628.

Formalin as used in foods retards digestion, 2607. Experiments show the arrestive action of formaldehyde on pancreatic ferments, 2619. Formaldehyde not justifiable in food, 2626, but in foods only occasionally used, may possibly be harmless, 2627. It is a blood poison in large doses, 2629. Its poisonous effects in proportion to antiseptic efficacy not known, 2630-32.

Salicylic acid in cider persistently consumed found to cause internal disturbance, 2611.

Prohibition of boracic acid in milk should be absolute, 2606, as should all preservatives, 2627-28.

Diarrhœa in infants thought of in relation with boracised milk 2605-7, 2628.

Milk kept sweet by boracic acid as ordinarily used for a limited period only; injurious products in boracised milk may be formed, 2605, 2612. Micro-organisms found to have multiplied in boracised milk, 2613-16.

Coppered peas should be prohibited. Copper not a constituent of the body. It produces chronic poisoning, 2621. Occasional doses of coppered peas could not be proved harmful; but the more potent as a preservative copper becomes the more harmful also, 2622.

Colouring matters apart from copper not studied, 2623-25.

Poore, Dr. G. Vivian, M.D. (Digest of his Evidence.)

F.R.C.P., M.R.C.S., 7336, Physician to University College Hospital, 7337, Professor of Medical Jurisprudence and Clinical Medicine at the University College, London, 7338.

Prohibition of preservatives advocated unless declaration of nature and amount be made, 7339-40.

Preservatives in certain cases harmful, and want of fresh food harmful to health of community, 7340. Scurvy follows prolonged use of preserved food, 7341, 7414-17. Food chemically preserved might be positively harmful, 7342, but ignorance at present obtains as to the action of chemical preservatives, 7341, 7349. No reason why chemical treatment of food should not be innocuous, 7421-22. Preserved vegetables have failed to prevent scurvy, 7343. Scurvy decreasing by reason of added precautions, 7344. Even preservatised lime juce has failed as an anti-scorbutic, 7345. Fresh food most important, 7346-47, and productive of energy, as instanced by animal life, 7350-60, and preservatised food different from fresh food, 7348-49. There should be no confusion between fresh and preserved foods; even frozen meat loses its flavour, and a great deal becomes flabby and unappetising, 7361. Salt meat speaks for itself, 7362, whilst preservatised and preserved foods do not, 7363. People should be able to get fresh food, 7373, and should use it in due proportion, 7376. It should be produced near centres of population, 7418. Preserved food inevitable, 7374, and demanding its place in dietaries. Best mode of preservation should therefore be adopted, 7375. Fresh and preserved foods should be differentiated, 7391-93. Preservatives may deceive on this point, 7412-13.

Nutrition much to do with susceptibility to fatal disease, 7394-97.

Milk preservatised soon ceases to be fresh milk, 7349. Advantage gained if milk kept from going putrid, 7364, or if germ growth be inhibited; but milk treated for the consumer is not like the milk as drawn from the udder, 7365, 7420. A great thing to give people wholesome milk, 7420. Modern conditions among the poor for keeping milk very bad, 7419.

Sterilised milk cannot be regarded as the same thing as fresh milk, 7366. What happens to pasteurised milk kept under modern low-class filthy town conditions is matter of serious conjecture, 7419.

Declaration should be made of pasteurisation equally with preservatisation, 7367. All preservatives should be declared, 7377-79, 7381-82, 7386-89, 7391, and the amount of salt, 7380. No difficulty felt as to labelling, 7390.

Fraud goes on as to so-called "smoked" food, 7383-85. "Smoked herrings" painted with pyroligneous acid, 7385.

Colouring matters should not be used; such use is provocative of danger; they should be declared in butter, 7368. Uniformity of colour means artificial colouration, 7369. All aniline dyes should be declared, 7398-99.

Copper in peas indefensible, 7370, in any quantity, 7371-72, 7403-4. Held to be soluble in the human body, 7400-2. Fraudulent in peas, 7405; its usefulness not admitted, 7406. When used it should be specifically declared, 7407-11.

Prossor, Mr. Joseph Edward. (Digest of his Evidence.)

Has had a long experience of provision trade, 556-58, and as a bacon curer, 564.

Heavily salted goods not now saleable, 559-60. Much salt would be needed if preservatives were not used, 570.

American and Canadian hams packed in dusted borax, 594, and borax washed off after arrival, 597; home hams smoked as a rule, 595.

Boracic acid and borax mixture used as a preservative, 561-62, for dusting over mild-cured meat, 563, and used during the salting of the meat, and afterwards washed off, 566, 569, and at times in hot weather used as a solution to prevent fly-blow, 567, and this again washed off. It would remove all slime, 598, 607-9. Generally 4 ozs. per 100 lbs. of meat used, sometimes 1 lb. used, 569, 588-89, a good deal of this washed off, 590-91. It has some penetrative effect, 592-93. Kept on meat till cure complete, seven to ten days, 582-87.

Experiments made personally with continued doses of preservative without ill effect, 571, 574-81, 602-6. Preservative largely used in household, 599 even for children's food, 600, without ill effect, 601.

Gave expert evidence for defendant in proceedings as to boracised ham at Pontypridd, 571-72.

Radcliffe-Cooke, Mr. Charles Walwyn. (Digest of his Evidence.)

Member of Parliament, and cider and perry maker, 6574-75, 6590.

Cider and perry need no preservative; none used by witness, but sulphur burned in vessels, 6576, 6604, and vessels kept clean, 6605-6, and skim milk used for thickening purposes, 6576. Sulphur fumigation destroys germs and slightly retards fermentation, 6577, 6609-10. No objection to sulphur sterilisation of vessels, 6606. Many makers use preservatives, 6578, nearly all being preparations of borax or salicylic acid, 6579, which are put in at any stage of manufacture, to stop fermentation, sugar of boron being one kind, used also in mineral waters and non-alcoholic beverages, 6580. Sugar of boron used also in brewing; "Cynin" also used in cider; it consists of a solution of salicylic acid and borax in glycerine; experiment showed it an excellent preservative, 6581, but the cider kept by its use was not matured, and the control unpreservatised cider had been lying about unheeded. Another cider preservative, "Walter Gregory's Powder," consists of salicylic acid and a small quantity of red oxide of iron, 6582. Formalin seldom used in cider. "K.M.S." not analysed. Anti-ferments are used to make bad cider good. "Hawkes' Anti-ferment" of a different class. Formalin used for brewing and mineral waters. "Hawkes' Cider Restorer" used for decomposed, ropy, and unhealthy cider, 6585. Cider not often fortified, 6587-88. Preservatives known of from advertisements are from Somerset and Devon, 6589; advertisements handed in, 6603. Nothing known of the use of preservatives in French cider, 6591-92. Preservatives are substitutes for cleanliness and induce carelessness, 6593. Public probably know of their use, 6594. Certain firms advertise no chemicals as used, 6595, 6599-6601, and then use them, 6596-97. Declaration of preservatives should be made by label on the bottles or vessels, 6598-99. Would not use boracic acid or formalin, 6607. They stop fermentation, cider never reaches maturity, and they are harmful, 6608. If preservatives permitted, no reason why present non-users should use them, 6611-12; and prohibition would affect only the dishonest trader, 6613.

Richmond, Mr. Henry Droop. (Digest of his Evidence.)

Analyst to the Aylesbury Dairy Co., 5639-40, 5726-27.

Preservatives not used by Aylesbury Dairy Co., 5641, save in some imported butter sold by them, 5642. Preservatives in general use principally boric compounds, 5643. Analysis handed in, 5644-45. Salicylic acid, soda, and magnesia in a glycerine solution also in question in two samples of preservatives, 5545. Formaldehyde also used, 5647. Difference between boracic acid, formic aldehyde, and salicylic acid in dilute solution one of degree, but in strong solution, one of kind, 5747. Fluorides not found, 5749. Hydrofluoric acid in large quantity found experimentally to be the most perfect preservative for milk; and fluoboric acid extremely strong preservative, 5750. Data promised, 5751-52.

Boracic acid as a commercial preservative contains on an average 56·8 per cent. of boric anhydride, 5676-77. Not a germicide, 5742, rather an antiseptic, 5743.

Salicylic acid stops the action of certain enzymes, 5745-46.

Formaldehyde used, 5647, believed largely, 5649, sold to trade in 1, and used also in 40, per cent. solutions, 5648. May be thought of as rendering milk less digestible, 5652-58. It kills micro-organisms, 5742, in relatively strong solutions, 5748, and is a disinfectant, 5744.

Analysis qualitatively of preservatives easy, 5702. Also quantitatively as to boracic acid and salicylic acid, but not formaldehyde, 5703-5, a volatile substance, 5706-10, and difficulty as to precise quantity originally present arises, 5711, and the strength of solution employed, 5712-14. Question of cost comes in as regards quantitative analyses, 5741.

Restriction of quantity of preservatives by limitation inoperative, 5753-54.

Prohibition of preservatives or nothing advocated, for several reasons, including liability to repeated dosage, 5754.

Milk vendors use formalin and boracic acid equally, 5650.

Keeping quality of preservatised milk matter of experiment, 5714-15 (App. No. 31). Trade purposes of Aylesbury Dairy Co. served by ability of milk to keep 18 hours, 5729, and should be so for all trade purposes, 5730-31. No need for preservatives to secure this, 5732. At 70° F. milk keeps sweet for 34 hours, for 22 hours at 80° F., for 15 hours at 90° F., bottled, in a chamber, 5732-33. Highest temperature of milk on first reaching Aylesbury Dairy Co.'s premises, 77° F.; highest on coming back from a round, 83° F., 5733. Some few complaints of sour milk, 5734-35. (*See Mr. Hattersley's evidence.*)

Cream preservatised by formalin, borax-boracic acid, and saccharated lime (called "viscogen") which retards curdling and evidence of sourness, and is an alkali, 5659-64. "Special Cream Compound" used, a borax-boracic acid-saccharin mixture, 5664-66. Aylesbury Dairy Co. used to use 0·2 per cent. of boracic acid in cream, 5667; not now, 5668; it was objected to, and found to be unnecessary, 5669. No preservative used now at all, 5670-72.

Butter preservatised by Aylesbury Dairy Co. years ago, 5673, but not now, 5674, 5679. Butter was either washed with a solution or had the acid worked in, 5675. By washing, some of the acid was retained in the butter, 5676, boracic acid itself being used, 5677, and ½ per cent. added, 5678. Done away with because objected to by the public, 5680-81, and as matter of policy, 5682. No consequential trouble, 5683. Butters imported from France are preservatised, 5684. Percentage of boric anhydride contained handed in, 5685-86. Still sell such butters, 5687. Boric compounds not absolutely necessary in such butters, but trouble may be caused by non-use, 5688. Salt equally efficacious, 5689. Danish butters found free from preservatives, 5691. Up to 1899 Australian butters found to be invariably preservatised, 5692-93; when two good saleable butters were found free, 5694-96, 5736-37, 5740, but with salt, 5738, some 2 or 3 per cent., 5739, and no absolute necessity for preservatives inferred therefrom, 5697. Quantity in such butters reduced of late, 5698, from 1 to ½ per cent., 5699, without known change of mode of transit, 5700-1.

Keeping butter leads to decomposition in three ways, 5716-18; dry butters tend to keep better than moist, 5719-24, but the action of water can be counteracted by salt, 5725. Trade purposes of Aylesbury Dairy Co. served by ability of butter to keep one week, 5728. Action of preservatives on butter chiefly chemical or chemico-biological, 5755-58.

Colouring matter used by Aylesbury Dairy Co., annatto only; its nature and constitution described, 5759. Aniline colours also being used in the trade, 5760, in extremely small amount, 5763, about $\frac{1}{100000}$, 5764. Colouring of butter should be standardised, 5762. Picric acid derivatives never found, 5765. Artificial colour in milk does not rise in the cream, but remains in the skim milk, 5862-63. Complaints have been made of uncoloured milk being poor, &c., when milk was excellent chemically, 5870-71.

Rideal, Dr. Samuel. (Digest of his Evidence.)

Doctor of Science and Fellow of the Institute of Chemistry, 3679.

Toxic properties of boracic acid studied experimentally, 3680. Dover case of alleged boracic acid poisoning not accredited, 3778-80.

Milk can be kept for 24 hours even in warm weather by formaldehyde $\frac{1}{50000}$, or a mixture of borax and boracic acid about $\frac{1}{2000}$, 3681. Preservatives should be added at time of milking, and then $\frac{1}{75000}$ of formaldehyde would suffice, 3697. Acidity of milk and organic growth rapidly take place, 3698. No known difficulty in adding preservative immediately after milking, 3699. It is done by some, and might be done by all, 3700. Milk containing a preservative can be kept sweet over night, 3762-64. It is probably 24 hours old in the morning, 3765-71. Admixture of preservative should not be left to consumer, 3777.

Invalids or very young children should not take unpreservatised milk, 3694.

Restriction of amount and also declaration of preservative in milk should be made, 3693.

Digestibility of food inappreciably affected by $\frac{1}{50000}$ of formaldehyde or $\frac{1}{2000}$ of borax and boracic acid mixture, 3681-82; only slight retardation takes place, as shown by experiments, 3683; experiments made of comparative effect on digestion of one and another article of food and drink, 3684. Circulation and cumulative properties of articles consumed have their effect on the system, 3685-86. Digestive mixture filtered, 3772-76. Higher proportions might be taken; the question one of idiosyncrasy, 3691. The amounts in question can be safely taken by the majority of persons if declared, 3694-95; they would suffice for trade purposes, 3696.

Rash known to be produced in cases by 20 grains of boracic acid, and an individual living on a milk diet might consume very nearly this much, 3692. Health aspects of large amounts of preservatives not studied, 3781-82.

Experiments on animals show that feeding of animals with formaldehysed food has no effect on the nutrition of cats, guinea-pigs, or rabbits, 3687; young cats difficult to feed successfully. Some kittens fed on formaldehysed milk, $\frac{1}{50000}$, and boracised milk, $\frac{1}{2000}$, and taking 70 c.c. of milk per diem, increased in weight; in later experiments cats of three months, and adult guinea-pigs and rabbits used, 3688-89, One animal fed first on formaldehysed and then on boracised milk also gained considerably in weight, 3689-90. No preservative needed for milk kept 39 hours at 55½ deg. Fahr., 3701-18; nor for milk kept 23 hours at 64 deg. Fahr., 3719-26; and preservative shows little preservative effect on milk even at the temperature of a summer's day, 3727; but there is just sufficient retardation of acidity of milk to justify the use of the preservative, in view of witness's opinion on the point of acidity of milk at which it curdles, viz., 0·25 per cent., 3728-57, and the preservative should be added before any appreciable acidity has started, 3758. The milks used for experiment were some three hours old, 3759-61.

Précis.

RILEY, MR. JAMES. (Digest of his evidence.)

Represents the Liverpool Chamber of Commerce, 816.

Butter importer, 818; especially Danish, 819. Trade purposes would be served if butter kept a month, 849. Condition as to keeping quality known only to depend on preservatives, 850, but imperfect make tells against keeping power, 851. Examination of butter would not enable its keeping quality to be determined, 852; nor would its texture affect it, 853-54.

Danish butter keeps as well as any, 819; salted to taste, but keeps with or without salt, 833; holds its own and commands good price on the Midland and Northern markets, 843-44.

Irish secondary butter is factory made, with salt and preservatives, 820.

Canadian butter sent without preservatives, 819, 839; it is pasteurised, 820.

Normandy butter entirely a South England commodity, 827.

Australasian butter imported, Australian with, New Zealand without, preservatives, 828-29, 832; presumably, 834-35, 837-38; latter comes in cold chambers, 830; fresh, 831; with some salt, 833; keeps sweet three weeks out of cold chambers, 846, in winter certainly, 847, when alone it comes, 848.

Preservatives unnecessary with well-made butter, 819, 836-37; extensively used in Irish butter, 820; not used in some creamery butters, 821-22.

Prohibition of preservatives in Canada, 819. This would kill the Irish butter trade, 820.

Pasteurisation accounts for good keeping quality of Danish butter, 819. To be commended, 823, 840; it improves butter, 824-26, 841. Danes have employed it some years, 842.

ROBINSON, DR. M. KENT. (Digest of his Evidence.)

Medical Officer of Health for East Kent Combined Sanitary Districts, &c., 3298-99.

Preservatives in food studied, 3300. Often in milk, though not found by analysts, 3307. Dover milk largely free from preservatives, 3308. Broadstairs milk said to be preservatised, 3309. Preservatives conceal dirt, putrefaction, and infective quality of milk, 3312. Should not be allowed in milk, 3335; not even if declared, 3336, and limited in amount, 3337-38. May be taken in many articles of diet in a day, 3336.

Milk treated with boracic acid by a dairyman, and also with "glacialine" containing as its basis boracic acid, by the cook, held to have led to serious illness of five of seven inmates of a house, the two who had not participated in the milk escaping. Milk taken alone, blended with tea, or in blancmange. Symptoms were vomiting, colic, suppression of urine, and great prostration. Of nine fowls which took the blancmange five pullets, which ate voraciously, died, 3301, 3345. Amount of milk taken by sufferers not known, 3342-43, 3346-47. The two inmates who escaped had a little milk in tea or coffee, 3314-16. Crop and gizzard of fowl and the milk examined. Blancmange not examined. Boracic acid held to have caused the illness, 3302. Quantitative analysis of milk not made, 3303, 3305. Boracic acid in large quantity found deep seated in fowl, 3303, 3344. Symptoms such as would be expected from borax or boracic acid, 3304. All possible factors other than boracic acid eliminated as cause of illness, 3305, in the house in Dover, 3306. Blancmange deemed the cause of the illness, 3313. Milk and blancmange both implicated, 3317; latter made of ground rice, eggs, sugar, boiled milk, and vanilla flavouring, 3318-19, and the contained milk held to be special factor, 3320, but some other constituents may have been in question, 3321. Farm furnishing the milk visited, 3322. Boracic acid added to the milk by the milkman, 3323-26, this and the added glacialine doing the harm, 3327. The milk would be consumed in other houses, but not known to have had glacialine also, 3328, and in this respect would differ, 3329, possibly, 3330-31. Quite possible that cases of infantile diarrhœa and enteritis in the town may have had relation with the particular milk supply, 3332-33. Possibility of preservatised milk having relation with infantile diarrhœa almost a conviction, 3334.

Boracic acid should not be added to milk, 3305, even if limited in amount, 3336-37. In 1 in 1,000 a baby might get an overdose in a day, 3338.

Experiments by large dosage of individuals with boracic acid not of much worth by reason of idiosyncrasy, 3339. Salicylic acid suits witness personally for gout, 3340. Would like to know when he was taking it in food, 3341.

Glacialine used in milk in Broadstairs, 3309.

Arcticanus used in milk in Broadstairs and the Isle of Thanet. Supplied from near Southampton, and pressed on dairymen, 3309. Basis unknown, 3310. Relation with intestinal mischief when used in milk thought of, 3334.

Formalin used because and since boracic acid has been detected in milk, 3311.

Benzoic acid used in France because and since salicylic has been detected, 3311.

Declaration of the presence of preservatives should be obligatory, 3312.

Injury held to have followed medicinal and surgical use of boracic acid, 3304.

SANDES, CAPT. THOS. WM. (Digest of his evidence.)

Started one of the first creameries in Ireland, in 1885, for butter-making, 77-78; saltless butter made with 1 lb. of preservative, and mild salted butter with, in addition, 3 lbs. of salt to every 112 lbs. of butter, 79; salt almost entirely replaced by preservative, English customers no longer taking heavily salted butter, 80; the latter contains 6 to 7 per cent. of salt, 84. Return to heavily salted butter impossible, 89.

Boracic acid used with the butter, alone or blended, 81-82; preservative never analysed, 83.

No complaints of use of preservative known; butter thus treated known to have kept a month, 87; it is necessary that it should keep a month, 107.

Preservatives have revolutionised the Irish butter trade, 88, but have not affected prices, 90-94; mixture with butter very intimate, 95-96; preservative very exactly weighed, 97, and the same proportion used all the year, 104; procured from Limerick firm of chemists, 98; only one kind used, 100-101; called boracic acid, 102; use advised by sale master as indispensable, 122; none used in milk prior to its reaching the creamery, 124; milk comes a distance of three miles at most, 125.

Saltless butter must needs be good to fetch its price; it fetches a better price than salt butter, 94, 105; very little made in winter, 105.

Mild-cured butter still marketable, 84; some people prefer a flavour of salt, 85-86.

Winter butter—stall-fed cows—not so good as grass butter, 105.

Experiment made with differently treated butter, resulted in favour of samples in which 1 per cent. of boracic acid used; those samples good at the end of nine months, 107-10; heavy salted sample was bad and uneatable, 109; butter need not for trade purposes be kept so long, 111-12.

Butter made expressly for English market, 113; weekly turn out, nearly a ton of butter; 1,000 cows supply the creamery, 123.

Danish methods of treating butter, under instructors, adopted, 115-16. Preservatives used in Denmark, otherwise the butter would not keep; their use winked at, 117-19; Danish instructors do not advocate boracic acid, but others do so, 120.

Hot weather sends butter bad in two days, 118: the butter would be rotten in a week, 120 no matter how prepared, 121.

SCHIDROWITZ, DR. PHILIP. (Digest of his Evidence.)

Doctor of Philosophy of Berne University, 7216, F.C.S., Analytical and Consulting Chemist, &c., 7217.

Beer, as preservatised, subject of evidence before Beer Materials Committee of 1898, 7218-22 (App. No. 34). Use of salicylic acid decreasing and of sulphites increasing, 7247-49.

Experiments made demonstrate preservatives to be unnecessary in refrigerated milk, 7223, 7230-31. Experiments described, 7224-29. Cooling of milk and storage at moderate temperature of vast importance in relation with keeping power of milk, 7233, and would obviate need for preservatives, 7234. Lactic acid bacteria less resistant to preservatives than other bacteria, 7245-46.

Cooling of milk should be enforced by Statute, 7235-37, under adequate inspection, 7238, 7242-44, though difficulty might arise as to enforcement, 7239-41. Initial cooling would allow of transit without material raising of temperature of milk, 7250; but refrigerator cars would be a great help, 7251. For cooling, 15° C. regarded as practically best, 7233, 7237, 7252-55. Maximum temperature of experimental milk in transit, uncooled, was 29·5° C., 7256-59; in milk cooled to 10·5° C., it was 11° C., 7260-61.

SHANAHAN, MR. HENRY. (Digest of his Evidence.)

Appears on behalf of the Cork Butter Exporters' Association, 341.

Butter could not be kept with one-half per cent. of preservatives, 343, as one-half per cent. of boracic acid itself is requisite, 344-45; necessitating three-quarters per cent. of preservative to be added, 376. Butter used to be passed through water, in which boracic acid had been dissolved in larger quantity, but the borax would not dissolve in the butter, 349, 351.

Boric glyceride, containing boracic acid and glycerine, an unworkable preservative, 347.

Boracic acid by itself used as a preservative, 348; but discontinued because found to be insoluble, 349; it was used in solution in hot water, which was allowed to cool, 350; as a preservative boracic acid has led to great improvement in butter manufacture, 385-86.

Preservatives generally insoluble and unworkable, 346-47; that now used in a dry form, 350; and added to butter before the salt after extraction of the butter-milk, 352-56; one-half per cent. of boracic acid added, 354-55; requiring three-quarters per cent. of the preservative, of unknown composition, 375-78. Preservatives prohibited in Denmark, but butter trade not thereby affected, 357-59; prohibition in Ireland would lower the value of butter all round, 361-62; and injuriously affect the farmers, 412. Preservatives are essential to the Irish trade, 363; and enable summer butter to be kept until needed, 390-94; price thereby regulated and market demands met, 395-97. Current prices largely determine the time butter is kept, 398; but prices do not affect the use of preservatives, 405-12. The effect of preservatives is to obviate a glut on the market, 413-14; they could not be dispensed with in perfected manufacture in Ireland, 441, because of poor keeping quality of butter, 442-49. Preservatives do not arrest putrefaction, 483-84; they are not added by suppliers of butter to the creameries, 486.

Factory butter processes described, 350; butter of different farms generally blended, 367, but only uniform qualities so mixed, 368. Factory and creamery system of manufacture a great improvement on old system in Ireland, 387-88. The factories in Ireland are on the Normandy system; the creameries in some of which Danes are working are on the Danish system, 488.

Butter-milk and water squeezed out of factory butter, 351; retention of butter-milk militates against keeping quality of butter, 387-88.

Danish butter naturally of better keeping quality than Irish, 364, because of cattle, their food, and land, 365-66; it deteriorates in price if kept over a week, 379-80; does not keep in a fresh state like Irish heavily-salted butter, 399-400; and has preference of sale in retail dealers' hands, 401-3; dairying carried on all the year round in Denmark, 415.

Irish butters of adjoining farms vary in keeping quality, 365-66. Manufacture improved by factory and creamery systems and the introduction of boracic acid, 387-89; preservatised butter known in the trade to keep well, 398; when heavily salted the butter will keep better than Danish butter; the latter gets preference of sale by the retailer, 399-403. Practically no dairying in Ireland in winter, 416-19. Butter delivered to creamery or factory once or twice a week, 457-58, 485, and sent out as a finished product daily, 459; average maximum period of keeping it a fortnight, 460-64; sold thereafter as cold store butter, 465-68; some mild salted butter will keep three weeks without preservative, 469-72, 477-78, in cool weather; but not so all Irish butter, 473; some will not keep a week, 474-76. Period of lactation of cow not known to affect keeping quality of the butter, 479-82. Manufacturers have nothing to learn from the Danes, 487.

Refrigerated butter found to keep best if preservative had been added, 381-84.

Salt needs to be evenly distributed in butter, 387.

Soil an important factor in determining the keeping qualities of butter in Ireland; limestone yielding softer butter than brownstone, 420-34; even when butter is salted, 435; the soft butter might have a heated smell, 436-37.

Rancidity of butter caused by imperfection of manufacture, 438-40.

Colouring matters used to keep butter colour uniform, 369. Danish butter colouring used, 370, composition unknown, but quantity required is small, 371-72; obtained from Copenhagen, through a Dublin agent, 373-74.

Milk for butter-making pasteurised, before creaming, 449-54, to rid it from feeding taint, 455-56.

SINCLAIR, MR. S. GIBSON. (Digest of his Evidence.)

Represents the Liverpool Provision Trade Association, 934.

Borax packing can be done with thoroughly cured and very dry bacon so as to keep the meat considerably over a month, 935, 943; its prohibition would kill the Canadian meat trade. No Canadian meat comes salted, 936. Borax practically all washed off the meat over here, 945. No injury to health from eating boracised meat known. Has eaten a great deal without any ill effect, 947.

Curing "thoroughly" a matter of time of keeping meat in salt, 943-44.

Refrigeration of American meat unsatisfactory by reason of loss of flavour in thawing out, and tendency to go bad, 936-37.

SMITH, MR. THOMAS CARRINGTON. (Digest of his Evidence.)

Dairy Farmer, County Councillor, and represents the Central Chamber of Agriculture, 4407-9, 4523-25.

Preservatives in dairy produce opposed by the Central Chamber of Agriculture by formal resolution, 4410-11, 4487. Preservatives advertised at Islington Dairy Show, 4540-44. List of preservatives handed in, 4544-47. (App. No. 11). Preservatives held to be seldom used by farmers, but often by dealers, 4549.

Prohibition of preservatives and colouring matters in all dairy produce and margarine desired by Central and Associated Chamber of Agriculture, 4487. Motive mere guess work, 4554-57. Staffordshire Chamber of 200 members, mostly farmers, favour colouring of cheese, but would prohibit it in milk as fraudulent, 4488, 4490-91, as also in margarine, 4489, 4521-22, and the resolution to this effect emanates from men doing a very considerable milk trade, 4492-4503. Prohibition of preservatives might temporarily restrict the milk supply, 4549, and raise prices for a short time, 4549.

Milk trade would not be interfered with if preservatives were prohibited, 4413-14, or only temporarily, 4549. None used by witness in sending milk to London from Mid-Staffordshire, 4414-15. No complaint of milk lost save as to Sunday milk sometimes, 4416-18, 4515. All save Sunday milk in consignees' hands in twelve hours, 4419-24. During four winter months milk only sent out once a day, 4425-27. His milk goes to Birmingham now for reasons of price, 4550-52. Milk from Aylesbury Valley sent to London without preservative, 4428-30; but milk cooled, 4431. Also from Faringdon, Berkshire, in large amount, 4440-41, 4539, and from a point equidistant with Staffordshire, from 1,500 cows, 4443-46. Cooling and straining of milk render preservatives unnecessary, 4515, in any part of England, 4549.

Cooling of milk essential, 4431. Apparatus of cold water tubing used, 4432. Some farmers do not command the needed water supply, 4433, which is necessary to long distance milk transit, 4434. Cooling chambers should be used by the consignees, 4434-35. Railway vans should be such as to keep milk cool, down to 60° F., 4435-39. Cooling of milk, plus cleanliness, keeps milk sweet during transit, 4504. Witness sieves milk three or four times and is particular as to cleanliness of cattle and sheds, 4505, and these have their effect on keeping power of milk, but cooling the most im-

Précis.

portant factor, 4506. No difficulty in the way of all milk being sieved, 4507-14, but difficult to get it done, 4516. All dairy farmers ought to have a good water supply, 4517-20. Dairies, &c., Order ought to be enforced, 4526-27, 4531. Drought at times a difficulty as to water-supply, 4528-30. Only cool water needed for refrigerating, 4531-34, even catch water suffices for witness, 4535-37, milk not coming in contact with it, 4538.

Keeping quality of milk affected by temperature, 4427, but greatly dependent on cooling, straining, and cleanliness, 4504-15.

Cream more likely to sour than milk, 4447, but point not personally vouched for, 4448-53.

Butter made, and no preservative used, 4454-55, 4473. Conditions of trade have changed, 4456.

Injury to health witness's reason for objecting to preservatives in milk, 4553. Butter not on the same footing, 4558-60. No case of injury known as regards preservatised dairy produce, 4561-64.

Colouring matters in dairy produce opposed by the Central Chamber of Agriculture by formal resolution, 4410-11, 4487. None used in butter made by witness, 4454-55, 4473, but used in cheese, 4457, for purposes of price, 4458-60, and to supply local demand, 4461, annatto being in question, 4462. List of colourings handed in, 4463-66 (App. No. 11). Annatto in chief use, 4467-70, but other colourings advocated by leaflets, &c., 4469, 4471-72. Colouring used by 64 of 100 farmers, dealers, &c., replying to questions as to dairy products, 4474-76. Colouring of cheese quite a supply of demand, 4477-78, and a matter of locality, 4479-80. Colouring not needed for butter, 4481-82. Food and breed of cow affect colour of butter, 4482-86.

Sorensen, Mr. Carl W. (Digest of his Evidence.)

Consulting Expert to the Manchester Pure Milk Supply Co., 6992, and formerly Chief Dairy Expert to New Zealand Government, 6993. Was seven years in New Zealand, 6994.

Preservatives first used experimentally in a few tons of butter, 6995; commercially nothing was gained by using them, 6996, but one or two boxes were reported to be very fine, 6997-98. Use given up, as expensive, 6999, and London Agents quite satisfied, 7000. Opinion was divided in New Zealand a few years back as to preservatives, 7001. Of circularised factories, 60 per cent. deemed them to be unnecessary or useless, and only 20 per cent. were in favour of their moderate use, 7002. Some of latter, largest exporters in the colony, 7003, and advocated only ¼ per cent., 7004; ¼ to ½ at the very outside, 7005. At the time witness left the colony, two-thirds of butter reaching England was not preservatised, 7006-7. Present condition of affairs not known, 7008, 7129, but reason to think increase of use since leaving, 7009. No doubt some pressure has been exerted, 7010-12.

Experiments made with preservatives, as chief dairy expert, 7013, showing slightly greater keeping power of chemically treated butter, 7014, the flavour being better preserved, 7015, ½ per cent. being the amount admixed, larger quantity flavouring the butter, 7016, giving it a saline taste, 7017. Experiments left witness unconvinced as to desirability of preservatives, 7018-21.

Prohibition of preservatives has been held to be likely to advance the price of milk, 7114. It need not do so, as evidenced by Copenhagen and Manchester, 7115.

Milk of Copenhagen Milk Supply Co. not preservatised, 7022. No preservatives used in milk supplies of towns in Denmark. They are strictly prohibited by law, 7023. They may be used in small villages, 7024, where the law is not so strictly enforced, 7024-27. Dr. Stein known by witness years ago, 7028. He is official analyst to Danish Government, 7029, and his functions extend all over the kingdom, 7030-31. Quite possible to supply large towns with unpreservatised milk, 7032, 7043. Manchester Pure Milk Supply Co. use no preservatives, 7033. They get milk from nine farms, 7048-49. Have existed for one year, 7050. Trade increasing, 7130-31. Customers of mixed, but chiefly of middle class, 7151-53. Sanitary conditions of lower classes in English towns perhaps not so favourable to keeping milk as in Copenhagen, 7154-56. Only one delivery of milk daily at Copenhagen, 7034, with advantages affecting consumer, 7035. Cleanliness and prompt cooling of milk enable one delivery to suffice, 7036. Cooling is relatively expensive, requiring ice, 7037, a commodity more easily obtainable here than is imagined, 7038-40, though difficulty may occur in parts, 7136-38. Ice preserved by stacking, 7041-42. One delivery daily would compensate for cost of refrigeration, 7044, and cheapen milk, 7045, with tendency to concentration of vending, 7046, but not of dairying, 7047. Equality of milk standard would also result, 7051-52. One delivery daily suffices for Manchester; hence also probably would for London, 7053. It is now welcomed in Manchester, 7059. Ice is requisite, 7132, but not for delivery twice daily, 7133-35. Manchester supply from places comparatively near at hand, 7054-58. Milk sufficiently cooled will travel 200 miles equally as well as 50 miles, 7058. Contracts of Manchester Pure Milk Supply Co. very stringent with farmers, and milk-cans cleansed before return, 7060, and farm water supply looked to, 7061-63, and cooling of milk to 40° insisted on, 7064, as requisite to a daily delivery, 7139-40. Price none the less lower than average vendor, 7064, 7158-60, *and foot-note.* Three per cent. of fat stipulated for, and all milk tested; average 3·5, 7065-70. Has fallen to 2·7 on a single day in August, 7071. Calving is regulated on a fixed basis, 7072-75. Milk is received in sealed churns, 7076-79. Separated milk dealt in, 7080-81, demand being some 6 per cent. of whole milk demand, 7082. There is annatto in most milk, 7083. Evening and morning milk differ in quality, 7093-96, and evening milk may be diluted to quality of morning milk, 7097-98. Desirable to stop the fraud of selling separated milk as whole milk or admixed with whole milk, 7084-7113. Customers of Manchester Pure Milk Supply Co. dealt with directly, 7157.

Pasteurising of milk in Denmark and Copenhagen not universal, 7171-74. Manchester Co. opposed to the practice, 7175, 7183, as unnatural and injurious, 7176, on medical advice, 7177, as rendering milk indigestible, 7178. It caramelises the milk sugar and coagulates the albumen, 7179, and flavours the milk, 7180-82.

Cream needs no preservatives if traded by proper channels, 7116-17, daily, 7119-20. The grocery trade has made them requisite, 7118. None used in Copenhagen, 7120, with extremes of temperature, 7121-22, and cream travelling three to five hours, 7123-24. From 140 to 150 grains of boracic acid found per gallon of cream taken haphazard in Manchester, 7141-45.

Boracic acid in 1 per cent. solution tastes butter, 7125-28, 7146-50. Two per cent. would render butter useless for this reason, 7161-63.

Transit of butter in refrigerator cars in New Zealand, 7164, and of butter and milk, also in Denmark, 7165-68. None such in Manchester, 7169-70.

Starling, Dr. E. H. (Digest of his Evidence.)

F.R.C.P. and F.R.S., 6933, and represents the Royal College of Surgeons, 6934.

Preservatives heard of as being most in use are formalin, salicylic acid, boracic acid, and borax, 6935-37. Use of preservatives of interest to medical profession, especially as to salicylic acid, 6967, in cases of rheumatism, for example, when results might prove to be very serious, if the amount were taken also in food, 6968, 6970, salicylate of soda being in question, 6969.

Harmful effects of borax and boracic acid as medicines vouched for on much evidence, 6944. Infantile scurvy might be produced by borax, 6945. Sterilised milk not likely to produce scurvy—that is malnutrition, 6946. Infantile scurvy said to prevail most in higher classes, 6947-48, who use most sterilised milk, 6949, hence cause and effect presumed, 6950-52. No direct experiments made, 6953. Unlikely that borax taken continuously can be other than harmful, 6955. Harm to infants from boracised milk known of, 6956. Irritant properties of sodium sulphite comparable with boracic acid, 6979. Has never prescribed the sulphite, 6980.

Contra-indication of salicylic acid in cardiac weakness, 6971, 6971*. Its indiscriminate use objected to, 6972. Boracic acid contra-indicated and dangerous in any lesion or disease of intestinal tract, 6973. Dangerous to feed a typhoid patient on milk containing 20 grains of boracic acid per pint, 6974, or a diphtheria patient; both would take much milk, 6975-76. In healthy cases no cumulative effects of boracic acid, 6977. Internal application of boracic acid not known, 6978.

Experiments made as to physiological action of formalin and digestive action of salicylic acid, 6938; with formalin in $\frac{1}{2000}$, 6960-62. Formalin takes away food character of proteids, 6939. In $\frac{1}{5000}$ formalin stops the action of pancreatic juice, 6963; not tested as to $\frac{1}{10000}$, 6964. Salicylic acid is less harmful than formalin, but is apt to cause stoppage of gastric digestion in the stomach, 6941. It is a potent drug, and should not be used unknown in food stuffs, 6942. Experiments on dogs do not show much against boracic acid or borax as used in foods, 6944. Experiments of Drs. Rideal and Foulerton as to formalin not known, 6957-59. Objections to formalin based on experiments showing its effect upon proteid and digestive activity, 6965-66. Experiments with artificial gastric juice are reliable, but harder on the antiseptic than those on the living subject, 6988-91.

Prohibition of formalin as a preservative should be absolute, 6940. Would feel inclined to forbid use of salicylic acid also, 6943. Would object to use of boracic acid and borax, especially in milk, 6944. Would not tolerate them in milk, 6954.

Prohibition of antiseptics in food advocated, 6986. Continued use of a preservative might have a tendency to diminish vitality of the human body, 6987.

Copper sulphate in peas will probably enter into combination with proteid constituents. Action of copper is very largely on the intestines, 6981-82. Is opposed to small amounts of copper for colouring peas, 6983. Would be dangerous taken constantly in ½ grain to lb. of peas, 6984-85.

STEVENSON, DR. THOMAS. (Digest of his Evidence.)

M.D., F.R.C.P., Public Analyst, &c., &c., 4796.

Preservatives in food studied, 4797. Those most commonly used in milk are boracic acid and formalin, 4804. Former said to have caused nausea in five grain doses, 4821. To taste a food it must be in excessive amount, 4832.

Sterilising of milk held to tend to innutrition, 4804.

Milk to Guy's Hospital found once to contain boracic acid. Preservatives now prohibited in the milk, 4798. Milk needs no preservative if properly cooled, and due regard paid to cleanliness, 4801. Large vendors use precautions which render preservatives unnecessary, 4802. Preservatised milk should not be given to the sick, 4803, 4806, because of effect on digestibility by the use of boracic acid, and hardening effect of formalin, even in small quantities. Children should not use preservatised milk, 4804. Stale milk may be sold by reason of contained boracic acid to prejudice of purchaser, 4826-28.

Formaldehyde in milk altogether objected to, 4829. If allowed, quantity should be very minute, and difficulty arises as to determining small quantities, 4830-31.

Salicylic acid affects individuals injuriously, 4823. Objection to its indiscriminate use. Non-injury of many does not confirm non-injuriousness as seen by plumbo-solvent water poisoning, 4824-25.

Contra-indication of heavily boracised milk in typhoid fever, 4807, and acute nephritis, 4808-9. Injury to individuals may result from the indiscriminate use of boracic acid and salicylic acid, 4810.

Infants relatively more susceptible to boracic acid and formaldehyde than adults, 4848-50.

Experiments by Dr. Annett as to boracised kittens of value, and should be carried on upon a larger scale, 4805. Committee should undertake experiments as to effect of preservatives on animals, 4811, young animals, 4812-13, as monkeys, 4814-15, but objection obtains to the latter on account of mortality among them, 4816-19. Home Office licence necessary, 4820. Such experiments would be valuable; controversies need settlement, 4846, and nothing better than animal experiments can be suggested, 4847. But the Committee should undertake such experimental work, 4854, on animals, young and mature, 4855-56.

Prohibition of preservatives advocated, though a little boracic acid in butter might be allowed, but not in multiple articles of diet, 4832-33. No one should have more than 15 grains of boracic acid per diem under any circumstances, 4834-36.

Prohibition of preservatives in Guy's Hospital milk, 4798-99, as unnecessary and inadvisable, 4800.

Court of Reference as to preservatives and colouring matters would be valuable, 4851-53.

Colouring matters of late have undergone change for the better, especially in sweetmeats, no noxious dyes being now found, 4837, nor for 20 years past, 4838-39. Regulation a question of expediency. Colourings vary constantly, 4842. They should be scheduled, after experiments, 4843, which are essential, 4844-45.

Copper in peas used in diminished quantity, 4840. It should be prohibited, 4841.

STILL, DR. GEO. FREDERIC. (Digest of his Evidence.)

(Represents Great Ormond Street Hospital.)

Borax and boracic acid studied as regards children, 6784-86. In cases of 2½ grains of each to a pint of milk looseness of bowels has resulted. In another case distinct benefit accrued. Has given 2½ grains of each three times a day for epilepsy to older children, with good effect, when added with bromide, but looseness of bowels has in cases resulted, and in one instance the boracic acid had to be stopped, 6787-88.

Salicylic acid is commonly used, 6808.

Indiscriminate use of drugs as preservatives might be of serious moment for medical profession, 6806. 6810, especially as to salicylic acid 6808-9; but borax and boracic acid rarely used, and formalin never used internally, 6807. Physicians should know accurately the amount of drugs taken in food, 6810.

Harmful results may accrue from formalin as a preservative, but no considerable harm probably, 6816, It would interfere with digestion if long continued. Would be chary of letting children have anything containing it, 6817.

Milk should contain no preservatives if it can be guaranteed against going bad in consumer's hands without them. Some delivered to Great Ormond Street Hospital goes bad in summer by the time it reaches the children, 6789, 6813. Milk well cared for in the hospital, but two epidemics of diarrhœa definitely traced to bad milk there in summer, 6790. Desirable that hospital milk should be examined for preservatives, 6811. It could be done by arrangement outside, 6812. No preservative found in milk specimens examined from Great Ormond Street Hospital, 6814.

Sterilisation or pasteurisation and even boiling of milk held to be harmful to children, 6791, 6799, especially the former, 6800. Infantile scurvy or mal-nutrition follows prolonged heating of milk to a high temperature, 6792-93. Reason not known, fact remains, 6794, and is well recognised, 6795. The scurvy can be produced by almost any patent food, 6796. The disease increasing, 6797, and is due to such milk and foods, 6798. Freezing of milk might have like effect, 6801, moderate cooling would not, 6802.

Cream not much used in children's hospitals, 6803. Used chiefly for marasmus, 6804. Same objections apply as to preservatives as in the case of milk, 6805.

Butter going to Great Ormond Street Hospital has been found to contain 17·4 to 47·6 grains of borax per lb., and has been given to children, no ill results noted, 6814. Very little taken, and that only by a few, 6815.

Experiments *in vitro* not deemed important, 6818-20.

SYMONS, MR. HENRY. (Digest of his Evidence.)

Partner in firm of Messrs. John Symons and Co, Cider Merchants, 7262-63.

Preservatives in cider used by best makers in small quantity, 7264-65. Salicylic acid, saccharin, sulphite of lime, or soda used, 7266, the saccharin being soluble, 7267, a product of coal tar, 7268-69, identical with "Tigress Brand" of saccharin, 7270-72. Preservatives good in small quantity to arrest viscous fermentation, 7273-77. Has used preservatives hitherto under certain conditions, 7278-80. They should not be prohibited but limited, 7281, as to quantity, 7282-84. Salicylic acid not always used and only a small quantity at any time. A standard should be fixed, 7285; not more than ½ to 1 oz. of

Précis.

salicylic acid per 116 gallons, 7286-87, and $\frac{1}{8}$ to $\frac{1}{4}$ oz. of saccharin, 7288. Beer showing incipient taint would be beyond the aid of saccharin, 7289, as also would cider. Preservatives should be used from one to three months before public get the cider. Salicylic acid held in Court to do more good than harm as used in cider, 7290. Only best makers should be allowed to use it, 7291-92. Too much preservative might be harmful, 7305. From 1 to 2 oz. of soda would be used per pipe, 7306. About $\frac{1}{3}$ more used in America, 7307-9, and in Germany saccharin and salicylic acid used largely, 7310, about one-third more than above suggested standards, 7311. Has never used as much as Germans or Americans, 7312. A witness holding that preservatives are not needed in cider not one having a great experience, 7293. Pure cultures can be obtained for beer manufacture, 7294-99. Has isolated pure yeast from apple pulp, 7300, and has identified the organisms concerned in cider manufacture, 7301. There are many kinds of germs, yielding differing results. A constant germ might obviate need for preservatives in cider, 7302-4. Cleanliness no substitute for preservatives, 7313. Difficult to exclude such bacilli in cider making as to obviate use of preservatives, with a weak percentage of spirit, 7314-17. Sick cider would not be salicylised, 7318, but with indications of going wrong the acid would be added as a preservative, 7319-23. Such indications are exceptional, 7326. Pasteurising does not work well, 7324. It causes insipidity. It is practised in France and Germany, 7325. Too late to pasteurise cider quite ready for consumption. Preservatives in cider not universally advocated, but honest traders should be permitted to use a small quantity in case of necessity, 7327, 7335. Cider industry very ancient, 7328, but progressive, 7329-30. Perfection of keeping cider probably attained, 7331, and knowledge has followed experience, 7332, by the aid of bacteriology, 7333, 7335. Difficult to say if manufacture of cider has improved, 7334.

TRENGROUSE, MR. HENRY. (Digest of his Evidence.)

Appears on behalf of the London Chamber of Commerce, 612. His firm represents the packing house of Armour and Company, of Chicago, 611, 615.

Mild-cured provisions preferred now, 614, and produced in America, 616.

Hard salted bacon and hams and no other from America years ago, 615. Salt conceals defects in produce, 656-57. Salted meats not now saleable, 665.

Bacon and hams come from America dusted with powdered borax, 618, which is washed off, 619.

Boracic acid chief preservative used, 617-18. Is intimately mixed with butter, 625, 628; probably mixed also with French butter, 627. Factories advised to use one half per cent., 646; but two per cent. said to have been found in some Australian butters, 647-48. No stipulation made as to percentage to be used; traders at mercy of shippers and manufacturers, 649. None added by witness's firm, 651. It does not conceal defects of butter, 655. Would impart flavour only when largely employed, 658. It may be added both at creamery and factory, 659, 662. Use needs systematising and standardising, 660, 702. Second dosage obviated where butter is made at the creamery, 664. Highest percentage known in butter is three, 678. Is superior to salt as a preservative. No ill effects heard of from its use, 702.

Prohibition of boracic acid would result in a return to salted butter, 703.

Butter brought largely from Australasia, 620, in cold chambers, 623, unsalted but with boracic acid in it, 621-22, and will keep out of cold chamber for two or three weeks, but without boracic acid would deteriorate very rapidly, 624. This butter improving and coming into favour at lower prices than Danish, 650. Moist butters of delicate texture call for preservative, 652; Australasian butter does so, 653, 673. It passes from creamery to factory, 662. All stock more than a week old is cold stored, 665. The butter ought to be made to keep a month out of cold store, 666-73. It is on shipboard five to six weeks, 677. Plenty quite as good as Danish, 689. Its introduction has brought down Danish prices, 702.

Danish butter believed not to contain any preservative but 1 per cent. or more of salt, 630, 654; difficul in keeping it, 631, 654; but it is very solid and free from moisture, 635, 674-75, and thus keeps longer than Brittany butter, 694-96. Forms bulk of English trade, 679-81, 683-85, 693; short voyage obviates need for preservatives, 682; none save salt is used, 686-87. The Danes get on without, 688. The butter commands a high price relatively 697; is chiefly used by the middle class, 698.

Normandy butter needs rapid consumption, 632, also Brittany butter, 633, which soon goes off unless preservative be used, 634. More moisture in these butters than in Danish butter. Brittany butter creamy, demanding day by day consumption, 635-36. It is factory made, 637. Normandy and Brittany butters most in demand in London, 692. Brittany butter commands the highest price, 698.

Irish butter could be introduced for immediate consumption without preservatives, 690-91.

Moisture of butter determines its price, 699, and keeping qualities, 700-1.

Colouring matter, annatto, used for butter at most factories, 638-39, and largely for cheeses, 643-45.

Tinned meats slightly salted, 642.

TUBB-THOMAS, MR. JOHN. (Digest of his Evidence.)

County Medical Officer of Health for Wiltshire, &c., 4923-25, 4947, 5046-48.

Diarrhœa in children found to get worse when treated with 1 to 5 grains of boracic acid in their food, 4926, in Newport (Mon.), 4927, an industrial town; the milk ordinarily taken by the children containing from 40 to 120 and more grains of boracic acid per gallon, 4928, as ascertained by analysis and by the word of the milk vendors, 4929, who added the acid under a fancy name, 4930. Many children in question, 5001, at all seasons, 5050, for twelve months, 5051, in one locality, 5002; no multiple attacks in houses, 5003. Milk drinkers alone attacked, 5004, 5008, and all milk from one source, 5005, 5007, which hit all children alike, 5006. Other similar experiences had, 5052-54. Diarrhœa rate among children thought of as influenced by preservatives, 5009-10. The disease induced in phthisical persons on boracised milk diet, 5024-25. Doubtless the experience recorded above regarded as exceptional because of want of knowledge on part of medical profession, 5055-56. Boracic acid, salicylic acid, formic aldehyde prescribed by witness for diarrhœa and indigestion, 5056, but not since above experience, 5058, as no control can be had over the doses taken, 5059-61. Dose of boracic acid reduced 50 per cent. in new edition of Pharmacopœia, 5062.

Milk of high-class dairymen not so much boracised as of "over-day" milk vendor, who may doctor milk already treated, 4932. Boron compounds also used in private houses, 4933. Milk needs no preservative, 4934, even in the case of a large town, 4935, cleanliness being an absolute necessity, 4936-37, 5039-40, and preservatives putting a premium thereon, 4938, 5027-32. Milk is recklessly boracised, 4942-43, and trade by its use improperly carried on, 4944-46, and gross neglect of ordinary precautions and sanitation found where preservatives used, 4948. Milk should be consumed within forty-eight hours of being drawn, 4949. In midland and southern counties some 85 per cent. of milk consumed by children and invalids, 5021-23. Bacteria should be kept from milk rather than inhibited when there, 5026. Milk should be strained, cooled, and sterilised, 5039-40. Milk properly treated will keep forty-eight hours under all circumstances, 5041-44.

Pasteurisation used by some Wiltshire and other dairies, 4980, 4983-84, 4986. Trade springing up, 4982. Milk is bottled, 4985, at same price at Leicester, 4987. Exact temperature not known, 4988.

Transit of milk by rail may need improvement, 4970. At present harm may accrue, 4971-73. Matter easy of rectification, 5045.

Butter not in same case as milk, quâ use of preservatives, 4950-51. A difficulty arises in supplying large towns with fresh butter, 4952, at certain seasons, 4953, but Danish butter largely imported, 4954-55, without difficulty. Australian butters are preservatised, 4956. Many home creameries use preservatives, 4957. None known which do not, 4958. Witness would modify his view if he knew that large creameries did not use them, 4959-60.

Boracic acid used for dusting poultry, 4938, and recklessly used in milk, 4942-43. Also used for sausages, up to 80 grains per lb. in November, 4973, such quantity being recommended in the pork trade, 4974. Boric Syndicate pamphlet issued with one object in view, 4989, and is a collection of data, 4990, leaning one way, 4991, towards favouring boric compounds, 4992.

Formalin getting more used by dairy people, 4975-76.

Idiosyncrasy of witness to boracised milk and food, and to boracic acid as a drug, 4930, 5014-15. Most children and invalids idiosyncratic to preservatives, 5016.

Physiological action of boracic acid is to cause a certain amount of skin eruption, 4931. Medical profession generally ignorant of the injurious effects of boracic acid. Evidence in the pamphlet of the Boric Syndicate not altogether satisfactory, 4938-39. Harm held to result from administration as a drug too soon after food, 4939-40, and indiscriminate use objected to, 4941, as well as use unknown to the consumer, 4942. Formalin injurious if taken continuously, 4978. If medical men were aware of the substances used as preservatives and the extent to which used, mischief thereby would be looked for, 5011. Parallelism of lead poisoning and ergotism, 5012-13.

Sanitary improvement in rural districts put back by use of preservatives, 4946, 5027. Some farms in such a state as to render milk impossible of delivery without preservatives, 5027-32. Dairies, &c., Order not generally enforced, 5033-36. Proper water supply would result from enforcement, 5037-38.

Experiments on dogs of little value as compared with the human economy, 4993-96, so with cats, and in the laboratory, 5067-69. Kittens more nearly approximate to the human, 4996–99. Experimental evidence thus far not decisive, 5000, 5063, or satisfactory, 5063-66.

Declaration of preservatives not desirable, rather to be avoided, 4949, and not sufficient *quâ* children and invalids, 5017-20.

Prohibition of boracic acid in milk necessary; milk most largely used by children and invalids, 4932, 4934. All preservatives unnecessary, 4977.

Colouring of milk should not be allowed, 4961, 4968, because fraudulent, 4962. Not believed in or butter, 4963, nor for cheese, 4964-67. Should not be allowed in cream, 4969, or butter, or margarine unless it be very distinctly tinted, 4969, to prevent fraud, 4970. Colouring used for sausages, including rose pink, 4973.

VASEY, MR. SAMUEL ARCHIBALD. (Digest of his evidence.)

A Fellow of the Chemical Society, &c.; represents the "Lancet," 1975-77.

Examinations made of food and beverages over a series of years, and several preservatives found, and in some instances as a result of comment afterwards discarded by vendors, 1978-85. Exclusion of salicylic acid from beverages was made on account of hurt to trade by its known inclusion, 1986. Vendors of preservatised articles nearly always communicate with "Lancet," 1991.

Preservatives increasingly used, 1995, and at certain seasons cannot be dispensed with, 2003. Limit to their preserving power, 2004, and this fact important, 2056-57. Borax or boracic acid most frequently used, 2037, then salicylic acid, 2038, then formaldehyde, 2040, then benzoic acid, 2039, but only a few instances found of latter, 2043. Use of formaldehyde increasing, 2041; not so salicylic acid, 2042. Fluorides not found, 2044, though heard of in food, 2045. Use of benzoic acid and formaldehyde should be prohibited, 2046. Preservatives should be allowed in summer, 2047-48, in milk products, 2049. Public not self-protected against the addition of preservatives, 2065-66. Dates of use of preservatives becoming known, 2079-85. (App. No. 10.) Preservatives in food held to be injurious to health by medical men and physiologists reporting to the "Lancet," 2101-6.

Boracic acid and borax both found in food samples, 1987-88. Analysis made not quantitative, 1988-90, such analysis difficult, though accurate, 2036.

Copper in peas, 6 grains per lb. found, 2005, 2007, 2097, effect on consumers not known, 2008. Small portions of peas not sufficient for examination, whole lb. desirable, 2006. Copper not present as copper sulphate, 2009, but as a proteid compound, 2010, not soluble, 2011, though possibly soluble at times, 2012-13, as in the human economy, 2086-87. Distribution of the copper unknown, 2014, likely to be mostly on outside of peas, 2015, absolute uniformity of distribution not expected, 2019, though borne out by careful analyses, 2024-25, 2028-29. Put in to preserve colour, 2016. Some tinned peas contained no copper, 2017, 2030, but they were off colour, 2031-35. The physiological action of the copper must determine the question of its use or disuse, 2018. Difficulty in defining limit of quantity to be used, 2019-20, and of conviction on basis of quantity present, 2021. Limit should be determined, 2022-23. Declaration of presence sufficient if addition decided to be objectionable, 2026-27. Use prohibited in France, 2088, and prohibition recently withdrawn, 2089. Dangerous to add 7½ grains of metallic copper per lb. of peas, 2093. Declaration of amount of copper unobjectionable, 2094-96. Largest amount found not known, 2097-98.

Milk for infants and invalids should contain no preservative. London general hospital milk samples were found to contain boracic acid, 1992, 2099, 2100. Milk products should be guardedly preservatised in summer, 2047-51.

Invalid foods should not be chemically preservatised, 1992. Practically all the examined samples some years ago were so preservatised, 1993, but later samples were free from preservatives, 1994.

Declaration of preservatives should be made, 1996, 2003, 2052-56, and would suffice, 2067-69, though not in cases where boracic acid is contra-indicated, 2070-74.

Standards limiting use of preservatives desirable, 1997-98, 2050-51. Unequal distribution in food no barrier, 1999-2001, 2003; maximum limits should be insisted on, 2058, 2076.

Classification of foods *quâ* use of preservatives desirable, 2002, 2050, 2059, and feasible, 2003, 2060-64. Purchaser should be able to procure an article free from preservatives, 2003, 2052, 2078.

VOELCKER, DR. J. A. (Digest of his Evidence.)

Appears on behalf of the Royal Agricultural Society, 1635.

Preservatives examined, 1636, 1639, mostly those used for milk or cream, 1637, 1639, 1652. Could draw no clear distinction between those used for milk and cream, 1638. Not found in milk samples sent by farmers themselves, but only in those under the Food and Drugs Act, 1644. Not personally responsible for analyses referred to in evidence as made under the Act, 1670. No check on amounts used; this a great danger, 1676. Clear distinction between their use in milk and in cream and butter, 1692, 1748. Preservatives permit of goods being sold which should not be allowed, 1714, and which would decompose but for the contained preservative, 1715. Preservatives in milk should be prohibited, 1716. No wide experience of preservatised foods, 1737.

Declaration of use of preservatives should be obligatory in milk and cream, 1716, 1749.

Quantity of preservative in milk and cream should be limited and standardised, 1749-50.

Boracic acid preservatives commonest in milk, 1639, 1643.

Salicylic acid used in milk formerly, not recently found, 1643.

Formalin never yet found in milk, 1643. It renders food indigestible, 1817.

Butter samples frequently boracised, 1652, some home and some Colonial, 1653. Only boracic acid preservatives plus salt found, 1654. Australasian butter with and without preservative kept equally well for six weeks, 1682, 1723-29. Quite possible to send the butter without preservative, 1683, 1720-22, 1730-32. Proportion so sent not known, 1684-85. Australian butter samples were examined about June last, 1702-3, six in number, 1717-19. Rancidity could hardly be masked by preservatives, 1714. Different pastures said to produce butters of different keeping qualities, 1733. Is sceptical on the point. Butter properly made under proper conditions requires no preservative, 1734. Sterilisation not a necessity, 1743-47. Not aware that Danish instructors have failed in Ireland to produce butter of Danish keeping quality, 1735-36, 1738.

Précis.

Milk preservatised may furnish differing quantities of the admixture in different samples, 1640-41, 1671. Those containing preservatives mostly adulterated or mixtures, 1652. Preservatives may be repeatedly added to milk, 1672, haphazard, 1673-75. Samples examined not decomposed, 1698-1700. Decomposition does happen, 1701. If started it could hardly be veiled by preservatives, 1712-13, but the preservatives enable milk of bad keeping quality to be sold as good milk, 1715. Keeping quality affected by insanitary surroundings, 1739, and by health of cow, 1740-42. Milk is rendered indigestible by formalin, 1817.

Cream in jars often has all the preservatives at the top, 1642. Should contain no preservative without declaration, 1749.

Condensed milk sample (Australian) found to contain ½ per cent. of boracic acid 1645, 1648-49, in 1898, 1649*, a high percentage, 1646, and not a safe one, 1647, and reckless, 1650. An exceptional case, 1677, and sent privately, 1678; reason not remembered. 1679-81. No need for a preservative in such milk, 1651.

Ciders, American, of low alcoholic strength and bad keeping quality, contain salicylic acid, some also glycerine, 1655-56. Quantity not determined, 1656. In 1895-96, 1657, samples brought by complaining English manufacturers, 1655, 1658. Ground for prosecution, quantity large, 1659.

Temperance drinks not examined, 1660.

Jams and preserves examined, 1660. One sample of strawberry jam had 3½ grains of salicylic acid per lb., 1661. Its presence objectionable, 1662-63, 1708, and used to cover imperfections, 1664, 1706. Not necessary in well made jams, 1664, 1704, or fruit pulp, 1706. Imported pulp cheapens the jam, 1707, and it is practically impossible to import pulp without preservative, 1708.

Rennet found to contain boracic acid preservative, 1685, the only sample examined, 1686.

Cattle food cakes, test samples contained borax purposely added, 1687, in cotton cake 1 lb. to a ton, to preserve colour, 1688, 1690, and may cover inferior make, and excess of moisture, which moisture may lead to fermentative changes, 1689-90. Such preserved cake has not been adopted, 1709-10. Borax not used in the trade, 1710, nor formalin, 1711.

Colouring matters found in jam, aniline dyes in sweets and pop-corn, 1666-67; no analyses made personally, 1668-69. No excuse for use of colouring in milk, it is usually fraudulent, and should be prohibited, 1691, 1748. Not so in butter, 1691. Butter alters its colour naturally. Usually fraudulent in margarine, 1692. Characters of colourings not much known, 1694-95. Colouring of peas not gone into much, 1696-97

WALFORD, DR. EDWARD. (Digest of his evidence.)

Medical Officer of Health for Cardiff, 1820.

Analysis of food and drugs to the number of 600 samples made in Cardiff annually, 1821-24. Population, 186,000 persons, 1909.

Preservatives reported on for Cardiff Town Council, 1825. Antiseptics, such as boracic acid and formalin, should not be added to food, 1826, butter and milk being the chief foods personally in question, 1827. Use of antiseptics general and increasing, 1828, 1853, 1921; boracic acid especially in question, 1854-55. Use unnecessary, 1837, 1886-88, though a trade convenience, 1838. Use may lead to lack of cleanliness, 1839. May conceal incipient decomposition, 1846. Proof of harm from preservatives would render them physiologically indefensible, 1872. Quantity used an important factor, 1873. Useful quantity very questionably harmless, 1874. Cooking would alter formalin present in food, 1918.

Prohibition of use of preservatives would not seriously affect urban milk supplies, 1909-10, 1928. Populous places better supplied with milk now than formerly 1911. Prohibition in Austria, France, and Germany, 1929. No reason why England should not follow suit, 1930-31.

Declaration should be made of the admixture of chemicals in food, 1836, but would not suffice, 1837, 1871. Public should be protected against chemicals in food, 1870.

Boracic acid is a drug, used medicinally, 1835. Some persons may be very susceptible to it, 1847, and might take large amounts in food, 1848-49. It interferes with digestion, 1856, 1859-60, even in small quantities, 1857; this known from reading, 1858, of experiments made in laboratory, 1863-64. Experiments not regarded as typifying human conditions, 1865, 1898, and very trivial in their differences, 1866. Systematic feeding experiments would be important, 1899-1900. Poisoning cases not known, 1867, or heard of, 1868-69. Dose for a child some 3 grains, 1875. This should certainly not be exceeded in boracised milk, 1876. Sixty grains in foods in addition to the same as a prescribed medicinal dosage daily for an adult objectionable, 1877, and a danger, 1878. Many conditions under which medicinal use of boracic acid would be hesitated about, 1879-81, *e.g.*, pregnancy, 1882, 1884-85, and objection obtains as to its indiscriminate use in food, 1883. Cooking would not alter it, 1907-8.

Milk entering Cardiff boracised to some 8 to 13 per cent. of total samples examined, 1829-30. Quantitative analyses made, 1831. Lowest quantity of boracic acid found, 0·004 per cent., highest, 0·105 per cent., 1832; 0·05 per cent. would give 7 grains per quart; 0·1 would give 14 grains per quart, 1833. Such proportion might be harmful, especially to an infant, 1834. Use of preservatives in milk a serious question, 1927. Minute traces of formalin have been found in milk, 1840. Seasonal influence upon the presence of boracic acid not known, 1851-52. Powdered borax applied to milk and cream, 1901, and not always intimately mixed, 1902, thus tending to vitiate analyses, 1903. Sometimes sprinkled on top of cream, 1904, and hence located there, 1905-6. Strictly pure milk more important than unstinted supply, 1912-13. No preservatised milk found decomposed, 1914. Cardiff milk supplied from its home counties, 1919, some eight hours old when handed to consumer, 1920.

Butter in 1898 found to contain boracic acid in 44·5 per cent. of samples examined, 1841. Proceedings taken in one case, 71·4 grains per lb., 1842. Warranty led to dismissal of case, 1843-45. Percentage of 0·25 of boracic acid said to be needed to preserve butter, 1861, how long not known, 1862.

Bacon and ham not examined for preservatives, 1850.

Diarrhœa studied, 1889. Most prevalent during hot months, 1890-91, when most preservatives presumably used, 1892, and probably kept up by use of boracised milk, 1893. Mortality varies with summer heat, 1894. Sanitation ought to have reduced mortality beyond its present rate, 1895-96. Diarrhœa and milk diet closely related, 1897.

Ptomaine poisoning not a subject of study, 1915-16.

Colouring matters used a little, 1922, in milk and butter, 1923, in preserves, 1924, and preserved fruit and vegetables, 1925. No personal knowledge of use, 1926.

WILD, DR. ROBERT BRIGGS. (Digest of his evidence.)

Assistant Lecturer on Materia Medica and Therapeutics at Owen's College, Victoria University, &c., 1413.

Boracic acid—doses personally taken of 10 grains at a time have not had any effect, 1416, no matter how or when taken. Acid tasteless; 15 to 20 grains not injurious in single doses, 1417, but continued daily doses of that amount for a week create slight disturbances, which soon cease on omission of the acid. Quantities up to 120 grains taken on occasion in some four hours, nausea and diarrhœa resulting, 1418. Has dosed patients with from 10 to 80 grains a day, 1420, in health and sickness, with benefit, 1421. Traces found in milk, 1442, of 1 in 1,000, 1443.

Excreted by the kidneys as an alkaline salt, and free boracic acid, according to dosages, 1419.

May safely be added in small amount in milk in health, 1429, 1444, 1 in 1,000, a quantity sufficing to keep milk for 24 or 48 hours, save in extreme heat. Not so with infants or in kidney troubles, 1429. An infant of three months would consume one or two pints daily, 1430, 1432, an adult on milk diet some two quarts, 1431, and 1 in 1,000 would give 9 grains per pint, 1433, a large dose for a baby, 1434, with resulting loss of appetite and nutrition if continued, 1435. Milk with a little preservative better than no milk, 1440, or sour milk, 1441.

Injurious effects, eruption, loss of hair, when 30 grains per diem taken, 1422, 1424-25, 1427, ceasing on cessation of dosage, 1423, 1427. Patient an adult, 1424. Effect of doses cumulative, 1427. Temporary albuminuria caused, 1447. Possible ill-effects outweighed by benefits to infants of boracised milk, 1458. No ill-effects seen from five grain doses in any case, 1459-60. Ten grain doses have produced some seven cases of known injury, 1461, out of 40 treated cases; only three cases of albuminuria known, and in one, 20 grain doses used, 1462. Toxic symptoms may arise from idiosyncrasy or kidney disease, 1463-66.

Contra-indication to its use is kidney disease with albuminuria, 1447-50, and large numbers of persons thus affected, 1450-52, even before medical advice sought, 1456, and absence of boracic acid from their milk diet important, 1455, but often not effected, 1457. Other contra-indications are certain conditions of the stomach, especially of digestive organs in children, 1467-68, 1470-71, the latter a prevalent class in Manchester, 1469. No other conditions of contra-indication known, 1472. No personal experience of use in pregnancy, 1473-78. Danger of giving boracised milk when kidney lesions in scarlet-fever present, 1497-98. Interest in the acid purely professional, 1487.

Declaration of its presence in milk important, 1436, 1444-46, 1453-55, and sufficient, 1488-92; but specific label desirable if possible, 1493-95.

Diarrhœa said to be less prevalent in certain children since boracised milk used, 7½ grains to the pint, 1480.

Milk partially decomposed may possibly be rendered saleable by boracic acid, 1481, and so may be conveying ptomaines to children, 1482, but matter not within the knowledge of witness, 1483. Milk sometimes containing no boracic acid in winter may do so in summer, 1484. Ideal milk would be without any preservative, 1493. Milk not injurious in enteric fever if only slightly boracised, 1496, but would not be given in scarlet fever, if other obtainable, 1497, and should be prohibited if intended for all cases of acute scarlet fever patients, 1498. Pasteurising practicable in Manchester, 1437-39.

Salicylic acid and formalin and copper in peas not within the knowledge of witness, 1485-86.

Colouring matters not specially worked at, 1487.

Williams, Mr. Walter Collingwood. (Digest of his evidence.)

Fellow of the Institute of Chemistry, Public Analyst, B.Sc., &c., 5145-46.

Preservatives in food studied, 5147. Boric compounds, formalin, and salicylic acid most commonly used, 5148. Borate found in sausages, pork pies, 5180. Boracic preservatives all mixtures, 5246-47.

Milk new and unadulterated seldom preservatised, 5149, in Liverpool, 5155; in skim milk and separated milk borates more common, 5149, 5300, in Lancashire, 5150, and in towns with large proportion of poor people, 5392, outside county boroughs, 5151-54. Borates found most in winter, 5156, when milk is most valuable, 5157; but data are few, and the basis of statement not of much importance, 5197-5215. Milk should not be preservatised, 5220. Supply of Liverpool can be carried on without preservatives, 5289-99. All milk samples examined for borates and formalin, 5300-4. Samples outside Liverpool hardly representative of Lancashire, 5305. Preservatives put a premium on cleanliness, 5306-7. Data as to milk sampling *quâ* preservatives promised, 5391.

Butter found to contain boracic acid and borates only, outside salt, up to 62 grains per lb., 5169-70, especially in summer, 5171. Boraxed butter used for cooking (say) fish, would tend to saponify the fat, 5232-42. That preservatised butter cannot be used for butter-scotch not known, 5243-45, 5248-50. Utility and necessity of boracic acid doubted, 5255, 5261.

Margarine samples nearly all contained borax or boracic acid, 5172, 5251-54. Mostly sold as butter, 5173-74, and much used in cooking; usually some 20 grains per lb., 5175. Utility of boracic acid or its necessity doubted, 5255-61, 5263, but trade seem to regard it as necessary, 5262.

Hams found to be cured with borax, with from 4 to 24 grains per lb. in the meat, 5176-77, the meat having been penetrated, 5178, some of the meat being foreign, 5179.

Bacon found to be penetrated by borates, 5180.

Cream samples found to contain boracic acid as a borate, 17 to 38 grains per pint, 5164-65, both potted and bottled, 5166. One sample unfit for use, 5167-68, and deemed to be injurious to health, 5325. Potted samples from grocers, 5221, who require the preservative to keep the cream, 5122-26, more than the dairyman, 5127-31.

Jam found to contain salicylic acid from ¼ to 4½ grains per lb., 5180. Bottled fruits and some jams found free from preservatives, which seem not to be needed in large, clean fruits, 5181, as opposed to small and easily damaged fruit, 5182. No proceedings taken, 5183, and difficulty apart from preservatives thought of as regards small fruit jams, 5184, but not upheld if makers do really get on without them; 4½ grains per lb. in any case too much, 5185. Use not decreasing, 5264-67. Quality of fruit a prime factor, *quâ* preservatives, 5268-71. With proper care all round, salicylic acid not requisite, 5272, and used, where used, often without thought, 5273, and its prohibition would not injure legitimate trade, 5274. One unpreservatised sample of jam contained mould spores, 5326-30. Imported pulps seldom preservatised; preservatives unnecessary, 5331-35.

Temperance drinks found to contain much salicylic acid, 5186. Lime juice cordial found to contain from 20 to 108 grains per gallon; none is needed, 5187. The acid stops fermentation, 5188. Salicylic acid and formalin, and salicylic acid and boracic acid found in samples, 5189. Unsweetened lime juice, but no sweetened lime juice cordial, found unpreservatised. In lemon squash, 50, in ginger wine 118, in raspberry wine, 133, in orange wine, 106, and in black-currant wine, 140 grains of salicylic acid per gallon, 5190-92; and the acid found in herbal ale, 5277, all really non-alcoholic wines, 5193, 5285-88. Proceedings failed in cases where taken in Liverpool, 5193, because of medical evidence in favour of use of the preservative, 5194-95, and of evidence of manufacturers as to fruit used; but amounts recorded are above all requirements, 5195. Children principal consumers of above beverages, 5278-80, who might thus get large quantities of salicylic acid, 5281-84, 5308-11.

Formalin less frequent than boracic acid in milk, 5160. Amount in milk cannot be told with precision, 5162, but detectable in milk, 5163. Objected to, 5216, as affecting digestion, 5217, and as enabling stale milk to be sold as fresh, and as putting a premium on cleanliness, 5218.

Boracic acid objected to as a preservative in milk, 5218-20. Borax in butter used for cooking fish would tend to saponify the fat, 5232-42. No difficulty in determining quantity of the acid in food, 5313-15.

Experiments made with salicylic acid showed retarding effect on digestion of boiled white of egg, but not on pancreatic digestion, 5196.

Proceedings successfully taken in Liverpool for formalised milk, 5158, 5161; and unsuccessfully for salicylised temperance wine, 5158. Use of formalin was increasing, and was checked by the conviction obtained, 5159. Conviction secured because formalin an adulterant and deemed to be injurious to health, 5316-21. Injury not known, 5322-24. No considerable account of case published, 5428-31.

Prohibition of preservatives in milk should be absolute, 5220. Salicylic acid should be prohibited as a preservative, 5275-76.

Colouring matter, doubtless harmless, used in spices and pepper, 5347-49. Harmless colours not objected to in butter, cheese, confectionery, and general fancy goods, 5350, and might be allowed, 5385-87. Colouring milk might be an offence, 5351; as fraudulent, 5352, 5420-21; not so with butter, 5353-57. Unknown red dye found in jam, 5361; and red dyes found in sausages and meat, 5362, 5377-78. Unnecessary and undesirable, 5363, 5370. Injury to health and fraud not in question, 5364-66. No colouring found in cocoa, tea, coffee, 5379. Control of colourings a difficult problem, 5334. Scheduling might be adopted, 5385. Injurious colours not met with now, but Dr. Campbell Brown has found lead chromate in sugar oranges and lemons, 5387-90. Iron and oxide of iron not usually classed as poison and poisonous salts, 5394.

Copper in peas used in diminished quantity; use requires very strict control, 5337-40, 5344-46. About 2½ ozs. of peas examined, 5341; from well-shaken samples 5342. Has found ¼ grain per lb. in peas quite green. Interior of peas found to contain copper, 5343. Copper is injurious to health, 5367; and along with its salts, poisonous, 5393. Minute quantity suffices for peas, 5369, 5380-83. About 40 per cent. of copper in peas enters the stomach in a soluble form, 5372-76. Copper used to green the peas, 5402; and fraudulent in the abstract, 5403-5; but purchaser not prejudiced, 5406; but consumer may be, 5407-15; no doubt is, 5420-27. No injury to health from ¼ grain per lb., 5417.

Declaration of colouring matters might prevent fraud, 5350. Should be made as to cocoa nibs coloured by red oxides of iron, 5395-5400; and of copper in peas, 5401.

Prohibition of copper in peas desired, 5358, 5416; and if not should be strictly limited, 5359. Peas proprobably unsaleable if not greened, 5360, 5368.

WILLIAMS, DR. WILLIAM. (Digest of his Evidence.)

Medical Officer of Health for the County of Glamorgan. Represents the Incorporated Society of Medical Officers of Health, 2108-10.

Boracic preservatives, 2188, 2190, especially in milk and butter, subject of action by Glamorgan County Council, 2111. Use of these preservatives utterly bad in principle, and held to have caused injury, 2112. Analyses made of vended samples of milk and butter, 2113-14. By whom preservative added in general not known; farm-dairyman added it in one instance, 2115. Addition in milk varied from 13½ to 210 grains per gallon, 2116, 2118. The latter unnecessarily excessive, 2117, 2121. No precise method of addition of preservative, 2119. Double addition may take place, 2120. Preservative not affected by cooking, 2124-25. Amount in butter has varied from 1 grain to 112 grains per lb., 2125; mostly imported butter, 2125*. Boracic acid nearly tasteless, 2139. Amount used varies with the season, 2141. Most frequently used in hottest weather, 2142, and most samples taken then, 2143. Borax and boracic acid are, one the salt, one the derivative, of the other, 2231. Boracic acid inserted in solution in fish and eggs, 2232. Found in decreasing percentage of samples of food in Glamorgan, 2239.

Injury to health from preservatives cannot be proved, 2133-34, 2183-86, and not known of, 2146, but certainly may arise, 2149-51. Question of injury based on experts' statements, 2180-81. Boracic acid no doubt a poisonous drug, 2195, but failure of observation may account for absence of proof of its injury in food, 2196-98. Different modes of its administration as a drug and in food may account for difference of action on man, 2199-2200. Boracic acid contra-indicated in certain diseases, 2213.

Diarrhœa regarded as persistent by reason of use of preservatives in milk, 2171-74, 2224-25, producing ptomaines, 2191, 2191*. No such cases known of, 2175-76, nor diarrhœa as induced by ptomaines, 2192, in milk or meat, 2193-94. Infantile diarrhœa not specially studied, 2216.

Declaration of added preservatives in milk and butter should be definite, 2140. Simple declaration would not suffice, 2147, 2152-53, 2212-14. Delivery or posting of warning notices would not be of much practical use in Glamorgan, 2154-63, save in the hands of medical men, 2164-68.

Prohibition of boron preservatives should be absolute as regards milk, 2112, 2140, 2169-70, and butter also, unless stringent rules as to quantities are passed and a minimum quantity only permitted, 2112, 2140. Prohibition of boracic acid in milk recommended by Glamorgan County Council, 2129. Convictions obtained where it was found, 2130-32, but injury to health could not be proved, 2133-34. Prohibition would curtail supply of dairy produce, 2148. It is absolute in France as to butter, if not also milk, 2218-20, save for export, 2220. Interests of dairy farmers not prejudiced by action of Council, 2221. Prohibition would effect small vendors, 2245-52, 2255-56, and might lead to monopolies, 2253, or co-operative associations, 2254.

Prosecutions have stopped use of boracic preservatives 2137, to some extent, 2138, 2144-45, 2222-23, without prejudice to interests of dairy farmers, 2221. Formalin may have replaced boron preservatives, 2240-41.

Dose of boracic acid in Pharmacopœia 5 to 15 grains, 2204-5. Much exceeded in milk, 2206-8, especially in the case of children, 2209-11.

Milk in danger of being sold in decomposed state if preservatives are used, 2112. Partly decomposed milk most frequently preservatised, 2182. Would not give preservatised milk to children or invalids, 2122, who are the largest consumers, 2123. Milk requires no preservative, 2170, 2177-79, 2257-58. Preservatives would not do away with sourness of milk, 2187, but would sweeten it, 2189, borax and boracic acid being in question, 2190. Innocuous quality in decomposed milk not known of, 2201-3. Amount in Sunday milk not known, 2217. Whether partly decomposed milk better by reason of added preservative not known, 2242-44.

Butter samples, to extent of 26½ per cent. of number, contained preservatives in 1899, 2126. Some were of salted butter, 2127-28. Seventeen grains per lb. enough to preserve butter. Proceedings instituted by Glamorgan County Council when double that amount found, 2129. Proceedings taken and convictions obtained, 2135-36.

Ham containing 56 grains of boracic acid per lb. formed the subject of proceedings at Pontypridd, 2226-28, 2234. Acid held to be introduced in cure, 2228. Certainly used for cure, 2229, but distinction between cure by and packing in borax not drawn, 2230. Curing process not known, 2232, 2234-35, but cure could not be effected by simply dipping in a boracic acid solution, 2233. Penetrative power of borax not known, 2236. Part of particular ham yielding borax not known, 2237-38.

WOMACK, MR. FREDK. (Digest of his Evidence.)

Bachelor of Science, M.B., and Lecturer on Physics at St Bartholomew's Hospital and Bedford College, 7473. Nominee of St. Bartholomew's Hospital, 7480-82, 7493.

Milk preservatised known in a few cases to have caused derangement, 7474; a small amount of boracic acid in milk having caused digestive disturbance in individuals, 7475-77.

Boracic acid used medicinally in large quantities has, according to Dr Church, caused digestive disturbance; not so in small quantity, 7492. Harmful doses were of 15 grains, 7494-96, every four or six hours, 7497. Not aware of 80 grains in a pint of milk, 7498, which would modify Dr. Church's opinion, 7499. Difficult to determine boracic acid quantitatively, 7521.

Prohibition absolutely of preservatives in milk and butter advocated by Mr. Lockwood, 7507.

Preservatives not strongly objected to, 7478, but regulation desirable, 7479. Antiseptics not necessarily destructive of all bacteria, 7487-88. No evidence of ill results in St. Bartholomew's wards from small doses of preservatives, 7502, 7523-24. No good results reported, 7503. Staff generally hostile to preservatives, 7504, 7508, and against their indiscriminate use in food, 7505-6.

Formalin not known from physiological point of view, 7483-84, but its indiscriminate use objected to, 7485, as interfering with digestibility of food, 7486. It might act on secreting power of cells, 7489. It is a hardening substance, 7490, and its use should be limited, 7491. Objected to by St. Bartholomew's Medical Staff in milk and butter, 7500-1. Formic aldehyde for hardening substances used in much higher proportion than as a preservative, 7513-15. The compound formed with proteids by formic aldehyde will be indigestible, 7516, and the formic aldehyde would render milk indigestible, 7517-18, and should be largely under restriction, 7519. Difficult to determine quantity present, 7520.

Salicylic acid difficult to determine quantitatively, 7522.

Colouring matters not subject of evidence by St. Bartholomew's Hospital, 7509.

Copper in any quantity likely to be highly deleterious, 7510-12.

INDEX TO EVIDENCE.

ALPHABETICAL LIST of Headings and Sub-Headings to be found in the Index, with References to the Numbers under which they appear.

Headings and Sub-Headings.	Reference Number in Index.
Ammonia	1
Analyses	2
Anthrax	3
Antiseptics	4
Germicidal Power	40a
Arcticanus	5
Bacon	6
Absorbent Power	6a
Condition	6b
Cure	6c
Hung	6k
Keeping Power	47a
Moisture	83
Preservation	6m
Preservatives	68e 1
„ Necessity	56c
Price	69a
Salt	80a
Saltpetre	81a
Slime	83
Smoked	6n
Tainted	60
Trade	91a
Use of Borax and Boracic Acid	68a 2, b5
American :	
Cure	6d
Quality	75a
Refrigeration	17h
Trade	91b
Use of Borax and Boracic Acid	68b 6
Use of Preservatives	68a 2
Canadian :	
Quality	75b
Use of Borax and Boracic Acid	68b 7
Danish	6g
Cure	6e, 9f
French	6j
Home :	
Export	6h
Quality	75c
Trade	91c
Irish	6l
Cure	6f
Beer, Preservatised	68f
Benzoic Acid	7
„ Prohibition	71a
Blanc Mange	65j
Boracic Acid	8
Albuminuria	65a
Analyses	2a
Bacon, quantity	76b
Character	8a
Contra-indicated	18a
Cooking	19a
Cream, quantity	76e
Cumulative Properties	24a
Declaration, simple	25a
„ specific	25b
Decomposition of Food	26a
Diarrhœa	27a
Digestion	65b
Doses	28a
Eruptions	65c
Excretion	65d
Experiments	31c
Flavour	34a

Headings and Sub-Headings.	Reference Number in Index.
Boracic Acid—*continued.*	
Germicidal Power	40b
Idiosyncrasy	43a
Indiscriminate Use	78a
Injection into Meat	8b
Medicinal Use	53a
Nausea	65e
Penetrative Power	62a, b, c
Physiological Effects :	
General	65f, g
Affirmative	65h, j
Negative	65k
Poisonous Properties	65l
Preservative Properties	8c
Proceedings	70a
Prohibition	71b
Quantity	76a
Seasonal Influence	8d
Surgical Use	8e
Use as a Preservative	68a 1
Bacon :	
Quantity	76b
Butter	8f
Admixture	68a 3
Detectable	68a 4
Essential	56a
Flavour	34b, d
Keeping Quality	47d
Objections to preservatives	68g 1
Percentage preservatised	64a
Proceedings	70b, d
Quantity	76d, h
Standard	86a
Stipulations	78b
Use	68a 5, b 8
Eggs	8g
Food	8j, 68b 11
Game	8k
„ Penetrative Power of Boracic Acid	62a
Margarine	8l
Meat	8m
„ Penetrative Power of Boracic Acid	62a
Borax and Boracic Acid :	10
Food	8j, 68b 11
Use	68b 4
Borax. (*See under "Boracic Acid" generally*)	9
Cost	9c
Flavour	34b, c, d
Manufacture	49a
Opposition to Use	9
Penetrative Power in Bacon	62d
Quantity	76b, c
Treatment of Bacon	6k, 9a
Bacon :	
Use	68b 1
Butter :	
Flavour	34b, d
Quantity	76g
Salt	80c
Use	68b 2
Canadian Hog-Products	9b
Hams	9d, 9e
Meat :	
Flavour of Boracic Acid	9f
Injection „ „	9f

Headings and Sub-Headings.	Reference Number in Index.
Boric Glyceride	11
Boron	12
Bacon	6k, 12a
Butter	12b
Butter :	
Adulterated	13a
Cold Store	17b
Consumption	13h
Country of Origin	13k
Flavour	34e
Fresh	38a
Hot Weather	13l
Keeping Power	47b
Milk	13m
Moisture	55a
Pasture	13p
Preservatives, Use of	68g 1
” Admixture	68g 2
” Declaration	25e
” Decomposition	26b
” Necessity	56d
Price	69b
Quality	75d
Rancidity	13q
Refrigeration	17j
Salt	80b
Soil	13t
Sterilisation	87a
Supply	13v
Trade	92a
Transit	93a
Uniformity	13y
Unsalted	94a
Winter	13z
American :	
Transit	93b
Argentine	13b
Australasian	13c
Borax and Boracic Acid	68b 9
Cold Storage	17c
Consumption	13d
Keeping Power	47c
Manufacture	49b
Pasteurisation	60a
Price	69c
Quality	75e
Trade	92b
Transit	93c
Use of Preservatives	68g 3
Belgian	13e
Brittany :	
Keeping Quality	47e
Price	69d
Quality	75f
Trade	92c
Use of Preservatives	68g 4
Canadian :	
Keeping Quality	47f
Pasteurisation	60b
Use of Preservatives	68g 5
Colonial :	
Borax	13f
Supply	13g
Use of Preservatives	68g 7
Continental	13j
Danish :	
Keeping Quality	47g
Manufacture	49c
Moisture	55b
Pasteurisation	60c
Price	69e
Quality	75g
Salt	80d
Supply	13w
Trade	92d
Use of Preservatives	68g 10
French :	13o
Borax and Boracic Acid	68b 10
Use of Preservatives	68g 13

Headings and Sub-Headings.	Reference Number in Index.
Butter—*continued.*	
Irish :	
Borax	68b 3
Cleanliness	16a
Cooling	17d
Creameries	23b
Factories	32a
Flavour	34f
Keeping Quality	47h
Manufacture	49d
Pasteurisation	60d
Price	69f
Quality	75h
Salt	80e
Supply	13x
Trade	92e
Transit	93d
Unsalted	94b
Use of Preservatives	68g 12
Water	95a
Butter-milk	13m
Normandy :	
Complaints	13o
Keeping Quality	47j
Quality	75j
Salt	80f
Trade	92f
Use of Preservatives	68g 14
Scandinavian	13r
Scotch	13s
Water	95b
Canadian Hog-Products	9b
Trade	92g
Cattle Food Cakes	14
Cheese	15
Cleanliness	16
Cold	17a
Colouring Matters. (*See after* "*Wine*" *below*).	
Contra Indication of Preservatives	18
Cooking	19
Copper in Peas and other Food. (*See after* "*Colouring Matters: Zinc Compounds,*" *below*).	
Cost of Preservatives	20
Court of Reference	21
Cream	22
Preservatives	68j 1
” Admixture	68j 2
” Declaration	25f
” Proceedings	70l
Transit	93c
Creameries	23
Irish	23b
Milk Supply	23c
Preservatives	68k, 68s 6
Cumulative Properties	24
Declaration	25
Decomposition of Food	26
Diarrhœa	27
Diet	27b
Infantile	27c
Sanitation	27f
Doses	28
Drugs	29
Egg Powders	30
Experiments	31
Animals, Adult	31a
” Young	31b
Boracic Acid	31c
Cats	31d
Dogs	31e
” Boracic Acid	31f
Feeding	31g
Formaldehyde	31h
Guinea Pigs	31j

Headings and Sub-Headings.	Reference Number in Index.
Experiments—*continued.*	
Kittens	31k
Boracic Acid	31l
Formaldehyde	31m
Preservatised Milk	31n
Laboratory	31o
Salicylic Acid	31p
Factories	32
Fish, Preservatised	8h, 33
Flavour	34
Fluorides in Food	35
Fly-blow in Bacon	36a
Food :	
Assimilation	37a
Boracic Acid	8j, 68b 11
Classification	37b
Decomposition	26
Infants' and Invalids'	44a, c
Fresh	38b
Preservatised :	
Declaration	25g
Preservatives :	
Necessity	56e
Foods, Fresh	38
Formaldehyde :	
Contra-indicated	18b
Use in food	68c 1
„ Milk	68c 2
Formalin	68c 3
Analysis	2b
Cooking	19b
Dairy Products	68c 4, c 5
Keeping Power	47l
Proceedings	70f
Declaration	25d
Germicidal Action	40c
Physiological Effects :	
General	65p
Affirmative	65q
Negative	65r
Fruits :	
Bottled	39
Use of Preservatives	68m
Game :	
Boracic Acid	8k
Germicidal Power	40
Glacialine	41
Meat	41a
Ham :	
Cure	42a
Pickling	42b
Sale	42c
Smoked	42d
Boracised	9d, 9e
Preservatives	68o
Proceedings	70e
Idiosyncrasy	43
Infants and Invalids	44
Ipecacuanha Wine	45
Jams	46
Benzoate of Soda	46a
Benzoic Acid	46b
Salicylic Acid	68z 3
Sugar	46c
Use of Preservatives	68p
Keeping Power	47
Lard	48
Manufactures	49
Margarine	50
Keeping Quality	47m
Sold as Butter	50a
Use of Preservatives	8l, 68q
Meat Extracts	51

Headings and Sub-Headings.	Reference Number in Index.
Meat Food :	
Use of Preservatives	8m, 9f 34c, 68r
Meat, Fresh	38c
Meats, Tinned and Potted	52
Medicinal Use	53
Milk	54
Adulteration	54a, 68s 3
Bacterial Action	54b
Cleanliness	16b, 16c
Cold Storage	17e
Condensed	54c
„ Use of Preservatives	68s 5
Consumption	54d
Cooling	17f
Decomposition	26d, f, g
Delivery	54e
Formalin	68c 5
Fresh	38d
Hospital	54f
Keeping Power	47n
Price	69g
Pure	54g
Separated	54h
Sour	26g
Stale	54j
Standard	86b
Storage	54k
Supply	54l
Transit	93f
Boracised	68a 6
Admixture	68a 7
Application	68a 8
Declaration	25c
Decomposition	26e
Diarrhœa	27d
Keeping Power	47o
Percentage	64b
Physiological Effects :	
„ „ General	65g
„ „ Affirmative	65j
Proceedings	70c
Quality	75k
Quantity	76f
Sourness	26g
Use	68b 12
Creamery	23c
Formaldehysed	68c 2
Pasteurised	13n
Preservatised :	
Admixture	68s 2
Cleanliness	16c
Complaints	68s 4
Dangerous	68s 7
Declaration	25h
Decomposition	26f
Diarrhœa	27e
Infants and Invalids	44b
Keeping Power	47p
Necessity	56f
Objectionable	68s 8
Proceedings	70j
Quantity, found	76j
„ used	76k
Use	68s 1
Moisture	55
Necessity for Preservatives	56
Nitrate of Potash	57
Orders as to Dairies, Cowsheds, &c.	58
Osmic Acid	59
Pasteurisation	60
Peas	61
Consumption	61a
Deterioration	1b
Digestion	61c
Preservation	61d
Uncoloured	61e
Penetrative Power	62

Headings and Sub-Headings.	Reference Number in Index.
Pepper	63
Percentages of Foods Preservatised	64
Physiological Effects of Preservatives	65
Poisons	66
Preservatives	67, 68d 1
Bacon	68e 2
Essential	56c
Butter :	
Admixture	68g 2
Character	68g 6
Complaints	68g 8
Consumption	68g 9
Declaration	25e
Detection	68g 11
Essential	56d
Keeping Quality	47k
Percentage	64a
Price	69h
Proceedings	70h
Prohibition	71n
Putrefaction	26b
Quantity	76m 1
„ found	76m 2
Supply	67s
Unnecessary	68g 1
Use	68g 1
Cider	68h
„ Proceedings	70k
Cleanliness	16d
Composition	67a
Cooking	19c
Cost	20
Cream :	
Admixture	68j 2
Declaration	25f
Quantity	76n
Cumulative Properties	24b
Cure	67b
Dairy Products	68l
Declaration	25d, e, f g, h
Distribution	67c
Essential	56b
Foreign and Colonial Law and Practice	67d
America	67e
Austria-Hungary	67f, 71l
Belgium	67g
Canada	67h
Denmark	67j
France	67k
Germany	67l
Norway	67m
Sweden	67n
Switzerland	67o
Germicidal Action	40d
Grocery Trade	68n
Idiosyncrasy	43b
Indiscriminate Use	78c
Infants and Invalids	43d
Medical Profession	67p
Milk :	
Admixture	68s 2
Adulteration	68s 3
Creamery Milk	68k, 68s 6
Declaration	25h
Necessity	56f
Proceedings	70j
Quantity	76o
Necessity	56b
Perry	68c
Physiological Effects :	
General	65m
Affirmative	65n
Negative	65o
Preservative Power	67q
Preservatives—*continued.*	
Proceedings	70g
Public	67r
Quantity	76l
Restrictions	78d
Standards	86c
Unrestricted Use	78e
Use, General	68d 2
Use of	68
Price	69
Proceedings	70
Borax :	
Butter	70b, d
Preservatives	70g
Prohibition	71
Benzoic Acid	71a
Boracic Acid	71b
„ „ Dairy Products	71c
„ „ Milk	71d
Borax :	
Bacon	71e
Competition	71f
Ham	71g
Prices	71h
Borax and Boracic Acid :	
Butter	71j
Formaldehyde	71k
Preservatives :	
Bacon and Ham	71l
Butter	71m
Cream	71n
Dairy Produce	71o
Indiscriminate Use	71p
Meat	71q
Milk	71r
Wine	68v, w, 71s
Salicylic Acid	72
Provisions, Fresh	38e
Ptomaines	65
Public Analysts	73
Putrefaction of Food	26
Pyroligneous Acid	33, 74
Quality	75
Quantity	76
Refrigeration	17g
Rennet	77
Restrictions as to Use of Preservatives	78
Sale of Food and Drugs Act	79
Salicylic Acid :	
Analyses	2c
Beverages	68z 1
Contra-indicated	18c
Declaration	25j
Doses	28b
Medicinal Use	53b
Physiological Effects :	
General	65s
Affirmative	65t
Negative	65v
Prohibition	72
Use in Food	68z 2
Wine	68z 4
Salt :	80
Bacon	80a
Butter	80b
„ Borax	80c
Saltpetre	81
Sanitary Condition of Dairy Farms	82
Slime	83
Sodium Fluoride	84
Sodium Hyposulphite	85

Headings and Sub-Headings.	Reference Number in Index.	Headings and Sub-Headings.	Reference Number in Index.
Standard	86	Trade	91
Sterilisation	87	Transit	93
Strychnine	88	Unsalted	94
Sugar	89	Vinegar, Preservatised	68y
Sulphurous Acid	68f, 90	Water	95
Temperance Drinks:		Water Supply to Farms	96
Preservatised	68x	Wine, preservatised	68v,w,71s

COLOURING MATTERS.

The following headings and sub-headings occur in the order here given :—

Colouring Matters :
- Analyses.
- Anchovy Sauce.
- Anilines.
- Annatto.
- Bacon and Ham.
- Beer.
- Beverages.
- Butter.
  - „ Nature.
  - „ Quantity.
  - „ Why used.
- Carmine.
- Cheese.
  - „ Nature.
- Chlorophyll.
- Chromate of Lead.
- Classification.
- Cochineal.
- Cocoa.
- Coffee.
- Confectionery.
  - „ Quantities.
- Dairy Products.
- Declaration.
- Digestion, Effects on.
- Foreign Law and Practice :
  - France.
- Fraudulent.
- Harmless.
- Health.
- Injurious.
- Iron Salts.
- Jams.
  - „ Quantity.

Colouring Matters—*continued.*
- Jellies.
- Magenta.
- Margarine.
- Martius' Yellow.
- Meat.
- Meat Extracts.
- Metallic.
- Milk.
- Oxide of Iron
- Pepper.
- Physiological Effects.
- Pickles.
- Poisoning.
- Preservatives.
- Proceedings.
- Prohibition.
- Restriction.
- Saffron.
- Sausages.
- Spices.
- Sugar.
- Sulphur.
- Sulphuric Acid.
- Tea.
- Turmeric.
- Vegetables.
- Wine.
- Zinc Compounds.

COPPER IN FOODS :
- Poisonous Properties.
- Prohibition.
- Uses.

Copper in Foods—*continued.*
- Foreign Law and Practices :
  - France.
  - Germany.
  - Italy.
  - Switzerland.
- Medicinal use.
- Peas :
  - Analyses.
  - Colour.
  - Complaints.
  - Declaration, Simple.
  - „ Quantity.
  - Demand.
  - Distribution.
  - Keeping Quality.
  - Physiological Effects :
    - General.
    - Affirmative.
    - Negative.
  - Poisonous Quality.
  - Proceedings.
  - Prohibition.
  - Quantity, found :
    - Maximum.
    - Minimum.

Copper :
- Peas :
  - Restriction.
  - Use.

Copper Sulphate :
- Uses.
- Quantity used in Peas.

Coppered Vegetables.

1. AMMONIA :
Irritant in certain quantities, *Boyce*, 2753.

2. ANALYSES :
Made for Crosse and Blackwell by a professional adviser, *Blackwell*, 4902–4.
Qualitative of preservatives easy, *Richmond*, 5702 ; also quantitative as to boracic acid and salicylic acid, but not formaldehyde, 5703–5 ; a volatile substance, 5706–10 ; and difficulty as to precise quantity originally present arises, 5711 ; and the strength of solution employed, 5712–14.
Question of cost comes in as regards quantitative analyses, 5741.

2a. BORACIC ACID :
Quantitative, difficult, but accurate, *Vasey*, 1987–90, 2036.
Quantitative, made of Birmingham milk samples, *Hill*, 2333.
No difficulty now in estimating amount in milk by a process of blank experiments, *Cassal*, 3866, 3870–71.
Quantity in food can be determined without difficulty, *W. C. Williams*, 5313–15.
Quantitative analyses, easy, *Richmond*, 5703–5.
Difficult to determine precise quantity, *Dupré* 5920.
Difficult to determine boracic acid quantitatively, *Womack*, 7521.
Qualitative, easy, *Bannister*, 3554.

2. ANALYSES—*continued.*

2b. FORMALIN :
Quantitative determination not yet possible to witness, *Cassal*, 3837, 3866.
Might determine 1–50,000 by colour process, *Cassal*, 3867–69.
Quantitative determination not known, probably impracticable, and hence danger *quâ* use in food arises, *Foulerton*, 4142–44.
Quantitative determination accurately impracticable, *Fisher*, 4753.
Difficulty as to determining small quantities, *Stevenson*, 4830–31.
Amount in milk cannot be precisely determined, but its presence can be detected, *W. C. Williams*, 5162–63.
Difficult to determine quantity present, *Womack*, 7520.

2c. SALICYLIC ACID :
Difficult to determine quantitatively, *Womack*, 7522.

3. ANTHRAX :
Animals insusceptible not known, *Annett*, 2669.
Mice susceptibility known, *Annett*, 2670.

4. ANTISEPTICS :
Should not be used in food, *Walford*, 1826–27.
Use increasing, *Walford*, 1828, 1853, 1921.

5. ARCTICANUS:
Used in milk, *Robinson*, 3309–10.
Relation with intestinal mischief when used in milk thought of, *Robinson*, 3334.

6. BACON.
6a. ABSORBENT POWER:
None in winter, *Bennett*, 142.

6b. CONDITION:
To-day better than ever before, *Kellitt*, 19.

6c. CURE:
Salt and saltpetre used, *Kellitt*, 16.
Not effected by borax or boracic acid, *Kellitt*, 17, 20; *Gregson*, 864.
Effected before borax is used, *Kellitt*, 64.
Process described, *Bennett*, 182–84.
Mild now preferred, *Trengrouse*, 614; *Gregson*, 858, 862.
Thorough cure a matter of time in salt, *Sinclair*, 943–44.
Less prolonged than formerly, *Davidson*, 1613.
By 0·6 per cent. of boracic acid better for stomach than old salt cured, *Bell*, 2821.
Suggested to be by injection of boracic acid, *Bell*, 2822–23; Mild, by use of borax, not elsewise imported, *Bannister*, 3485–86.
Bacon of Wiltshire brand cured by Harris & Co., of Calne, *Harris*, 5951–53. Salt and saltpetre used in the cure, 5954, and these alone, 5955.
American bacon cured with salt and saltpetre, and packed in borax, and this borax washed out over here, *Harris*, 5967. Borax not used for curing in home trade, and rarely in Ireland, 5979.
Mild-cured bacon possible without the aid of borax, though perhaps nothing better known for use from America, *Harris*, 5986. It can be so produced and exported, 6007. Injection of borax in brine very seldom made, and quite unnecessary, 5987. Mild-cured bacon was possible before preservatives came in, and trade now all year round, 6002-3. It is exported to greater distances than America, and in a state fit to go to the seller, not in a green state like the American exported meat, 6008-9.

6d. CURE: Bacon, American:
Formerly in salt, *Kellitt*, 15.
Mild produced, *Trengrouse*, 616.
Years ago only hard-salted, *Trengrouse*, 615.
Pickle used for some, by injection, *Gregson*, 865, 902-3.
This side, after transit by refrigeration, possible, but has failed, and is costly and risky, *Gregson*, 905-8, 909-13, 921-23.
By salt and saltpetre, and packed in borax, *Harris*, 5967.

6e. CURE: Bacon, Danish:
Improvement on Irish mode, *Kellitt*, 75.

6f. CURE: Bacon, Irish:
Like Danish, 20-30 years ago, *Kellitt*, 73-74.
Mild-cured trade growing, *Gregson*, 862.
Borax rarely used, *Harris*, 5979.

6g. DANISH:
Formerly too salt, especially "in pocket," not so now, *Kellitt*, 21, 65-67.
A large trade, *Faber*, 4232. No present regulations as to preservatives, but prohibition intended in meat products generally, 4233, on ground of injuriousness, 4234. Borax only used, and that in limited amount, 4235, and does not penetrate from outside, 4236. Injection of solution of salt containing borax is made into the meat in curing some bacon, 4237-40. Percentages given of salt in certain Danish, Irish, Dorset, and Wiltshire bacon, 4241-42 according to which injected meat might contain 0·4 to 0·8 per cent. of borax, 4243

6h. HOME:
Export trade of Harris & Co., large, *Harris*, 5956, 5988, but larger part of trade is home, 5989. Dried bacon packed in salt, 5957, in canvas bags in dry salt in cases for India and the Cape, 5958-59. No occasion foudn for borax packing, 5960. Canvas keeps out the salt, 5963. Method quite satisfactory, 5965. Bacon sent abroad is a little more salt and extra dry, 5990. Sent to India, Cape, China, &c., 5991-92, 6010, to hot climates, by steamship, 5993, probably in cool chamber, 5994. It is packed in the hold, 5995-96, and is in high temperature in many cases, 5997. No complaints received, 5998. Boracised bacon sent abroad from America by way of England, packed here again like English bacon, 6011-13.

6j. FRENCH:
Conditions as to presence of borax in imported bacon not altered, *Harris*, 5999; as experience has shown recently, 6000; but rather they are stricter, 6001. Temporary withdrawal not known of, 6014.

6k. HUNG:
And dried after borax washed off, *Kellitt*, 64.
Boron used in summer, *Kellitt*, 64.

6l. IRISH:
Formerly too salty, especially in the "pocket," this now altered, *Kellitt*, 21, 65-67.
Not preservatised, *Long*, 4658.

6m. PRESERVATION:
Borax only known method, *Bennett*, 171.
Methods other than borax unsuccessfully sought, *Bennett*, 171.
Borax only desired method, *Bennett*, 172.

6n. SMOKED:
On arrival in green state, *Hudson*, 506-8.
Would not do from America, *Harris*, 6037-38. "Smokine" known, but not used by best curers, 6039-41.

6o. TAINTED:
Less frequent since preservatives used, *Kellitt*, 39; obviated by them, *Gregson*, 873, 881-82.
Once marketable, and in demand, *Kellitt*, 52.
Is bacon not sweet, *Kellitt*, 53.
Obtainable, when used, at a cheap rate, *Kellitt*, 54.
Once preferred, apart from price, *Kellitt*, 55.
Caused much loss before preservatives used, *Bennett*, 188.
None now, save from negligence, *Bennett*, 188.
Not now marketable, *Bennett*, 191; *Bannister* 3497.
Seized now, *Bennett*, 191.
Related to bad or imperfect curing, *Gregson*, 916-18.
Taint not obviated in bad bacon by borax, *Gregson*, 916-18.
Occurs before complete cure, *Gregson*, 919-20.
Is in interior of meat and of flavour different to borax, *Davidson*, 1608-9.

7. BENZOIC ACID:
Never found in butter, *Hill*, 2351.
Used in France because, and since salicylic acid detected, *Robinson*, 3311.
Found in wines, *Cassal*, 3816.
Irritating when swallowed, *Hutchison*, 6743; in 5 to 10 grain doses, 6744; on an empty stomach, 6745; in single doses daily, 6746. Frequently prescribed for septic conditions of urine, 6747. No local stomachic irritation noticed when it was prescribed, 6748.

BLANCMANGE.
(*See under* Milk, Boracised, Physiological effects.

8. BORACIC ACID:
Not a trade term, *Kellitt*, 25.
Was used by itself, but discontinued as insoluble, *Shanahan*, 348–49.
Was used in hot solution after cooling, *Shanahan*, 350.
Mixed with borax, as a preservative, *Prossor*, 561-62.

8. BORACIC ACID—*continued.*
- Chief preservative, *Trengrouse*, 617-18.
- Superior to salt as a preservative, *Trengrouse*, 702.
- Not used 30 years back, *Gregson*, 858.
- Components borax and boracic acid, *Clement*, 1529.
- A drug, used medicinally, *Walford*, 1835.
- A saturated solution of $\frac{1}{30}$, *Bell*, 2827-28.
- Found in many vegetables, in wines, and hop plant, *Attfield*, 6550.

8a. Character :
- Borax and boracic acid are, one the salt, one the derivative, of the other, *Williams*, 2231.

8b. Injection into Meat :
- Unknown, *Gregson*, 902-3.

8c. Preservative Properties :
- Studied, *Corfield*, 5071.
- Service and security doubted, *W. C. Williams*, 5255, 5261.
- Only preservative to be condoned in any way, *Hehner*, 5614, and solely in butter, in annually diminishing quantity to vanishing point, 5615.
- As a commercial preservative contains on an average 56·8 per cent. of boric anhydride, *Richmond*, 5676-77. Not a germicide, 5742, rather an antiseptic, 5743.

8d. Seasonal Influence :
- Not known, *Walford*, 1851-52.

8e. Surgical Use :
- Relatively harmless for external use, *Handford*, 2264.
- Used as lotion and dressing with alleged bad results, *Handford*, 2283.
- Studied, *Bell*, 2783-84.
- Used largely for washing out bladder, *Bell*, 2797.
- Fatal results following internal washing, would equally have followed use of water, *Bell*, 2799, 2800-2.
- Inquiry held to have followed, *Robinson*, 3304.
- Used externally, *Corfield*, 5091.

8f. Butter :
- Objections made by Brazilian Government in 1891 as regards tinned butter, *Lovell*, 720.
- Large amounts kill bad flavour and partial decomposition, *Lovell*, 723, 783-89.

8g. Eggs :
- Inserted in solution, *Williams*, 2232.

8h. Fish :
- Inserted in solution, *Williams*, 2232.

8j. Food :
- Objected to, *Long*, 4661-63.

8k. Game :
- Sprinkled to keep it fresh, *Hudson*, 518-19.

8l. Margarine :
- Found in mixture of margarine and butter, and in margarine alone, *Cassal*, 3852.

8m. Meat :
- Sprinkled to keep meat fresh, *Hudson*, 518-19.
- Not common in fresh meats; sometimes used in sausages ; more commonly used in salt meats, German sausages (under $\frac{1}{2}$ per cent.), bacon, and ham (from $\frac{1}{3}$ to $\frac{3}{4}$ per cent.), *Fisher*, 4717.

9. BORAX :
- No opposition to use found, *Kellitt*, 7.

9a. Bacon, Treatment of :
- In boxes; dusted on bacon to prevent fly-blow and absorb moisture, *Kellitt*, 11, 12, 15, 23.

9b. Canadian Hog Products :
- Dry borax, only, used, *Bennett*, 138, 143-44
- Use became general 20 years ago, *Bennett*, 232.
- Sprinkled, 4 ozs. of dry borax to 56 lbs., during last 20 years, after cure, *Bennett*, 128-30, 184-87.
- Borax washed off on arrival here, *Bennett*, 128-30, 184-87

9. BORAX—*continued.*

9b. Canadian Hog Products—*continued.*
- Washing rids meat of 80 per cent of borax, and of whole in winter, *Bennett*, 140-42.
- Sprinkling only method known, *Bennett*, 151.
- Noticed more than in English and Irish bacon, *Bennett*, 135.

9c. Cost :
- Expensive, six or seven cents per lb. in America, *Gregson*, 888.
- Inexpensive for packing purposes, *Bannister*, 3488.

9d. Hams, Treatment of :
- American, packed with borax from three to six weeks, *Kellitt*, 57, 59, 63.
- Borax washed off by retailer, *Kellitt*, 58, 62.
- Only method known or desired, *Bennett*, 171, 172.

9e. Hams, Use on :
- Put on in packing process, *Kellitt*, 61.
- For preserving, after cure, with salt and saltpetre, *Bannister*, 3648.

9f. Injection into Meat Vessels :
- Not known, *Bennett*, 192.
- Would flavour the meat, *Bennett*, 192.
- In solution of salt made in curing some Danish bacon, *Faber*, 4237–40.

10. BORAX AND BORACIC ACID :
- Difference not known, *Kellitt*, 10, 25.
- Mixture guaranteed to contain 50 per cent. of boracic acid, *Clement*, 1530.
- Would be surprised to learn that $\frac{8}{10}$ths of the mixture consisted of boracic acid, *Clement*, 1531.

11. BORIC GLYCERIDE :
- Contains boracic acid and glycerine, and is unworkable, *Shanahan*, 347.

12. BORON :
- Preparation of borax, but drier, *Kellitt*, 24.
- Quick absorbent of moisture, *Kellitt*, 24.
- Objectionable ingredient in boracic acid, *McFadyean*, 1804.
- Boric compounds sold freely, but not in large domestic use, *Cameron*, 2531 ; boracic acid and glacialine the only known boric compound in Leeds, *Cameron*, 2537–38.
- Borax and boracic compound used as preservatives, *McCracken*, 2856, 3007–9.
- Boric compounds commonly used, *W. C. Williams*, 5148 ; borate found in sausages, and pork pies, 5180 ; boracic preservatives all mixtures, 5246–47.

12a. Bacon, use on :
- Hung bacon in summer, *Kellitt*, 64.

12b. Butter, use in :
- Boric compounds found, *Cameron*, 2528.

13. BUTTER :

13a. Adulterated :
- Most frequently preservatised, *Kaye*, 5458.

13b. Argentine :
- Refrigerated butter commands high price, *Lovell*, 773.
- Preservatised, *Clement*, 1516 ; $\frac{1}{2}$ per cent., *Lovell*, 774.
- Varying quality, *Clement*, 1515.

13c. Australasian :
- Australian butter known as "Colonial butter" *Clement*, 1506.

13d. Australasian : Consumption :
- As a rule within a month of leaving the refrigerator, but sometimes kept for months, *Clement*, 1544–46.

13e. Belgian :
- Does not keep well, *Lovell*, 766.

13f. Colonial : Borax :
- Wrappers soaked in solution effective means of preserving, *Bennett*, 202–3.

BUTTER—*continued.*

13f. Colonial : Borax—*continued.*
  Boraxed wrappers advocated, *Bennett*, 208, 214.
  No mixture, *Bennett*, 200, 201.

13g. Colonial : Supply :
  Never purchased, *Kellitt*, 49.

13h. Consumption :
  Now quick, *Jones*, 1342–46.

13j. Continental :
  On consumer's table in three days, *Lovell*, 793–95.

13k. Country of Origin :
  Chiefly Danish, *Kellitt*, 44.
  Secondary qualities from Ireland, *Kellitt*, 44.

13l. Hot Weather :
  Sends butter bad in two days, *Sandes*, 118; and rotten in a week, *Sandes*, 120, 121.

13m. Butter-milk :
  Expressed from Irish factory butter, *Shanahan*, 351.
  Retention militates against keeping quality of butter, *Shanahan*, 387–88.

13n. Milk :
  Pasteurised before creaming, to rid it of feeding taint, *Shanahan*, 449-56.

13o. Normandy : Complaints :
  None, *Hudson*, 501-2.

13p. Pasture :
  Sceptical as to effect on keeping quality, *Voelcker*, 1733-34.
  May effect texture but not keeping quality, *McFadyean*, 1761-62.

13q. Rancidity :
  Caused by imperfect manufacture, *Shanahan*, 438-40.
  Rancid butters analysed without detection of preservatives, *Boseley*, 1003-4.
  Known with preservatised butter, *Jones*, 1363-64, 1378-84.
  Would kill flavour of boracic acid, *Clement*, 1541-42.
  Could not be veiled by boracic acid, *Clement*, 1543.
  Could hardly be veiled by preservatives, *Voelcker*, 1714.

13r. Scandinavian :
  Sometimes preservatised, *Lovell*, 752-54.
  Only small export from Norway, *Lovell*, 756-57.
  Export of Finnish butter exceeds that of Norwegian, *Lovell*, 757.

13s. Scotch :
  "Fresh" butter is saltless and unpreservatised, *McCracken*, 2861.
  Used day by day, *McCracken*, 2938-39.

13t. Soil :
  Important in relation to keeping quality of butter, *Shanahan*, 420-37; *Lovell*, 772.

13v. Supply :
  In Newport (Mon.), local, Irish, and Danish, *Jones*, 1400.
  To Birmingham largely local in summer, and continental in winter, *Hill*, 2472, 2474.

13w. Danish : Supply :
  Chief, *Kellitt*, 44.
  Increasing in England owing to improved methods of manufacture, *Dale*, 260–62.
  Sale probably decreasing, *Hudson*, 538-40; replaced in good firms during winter by Colonial and Irish, *Hudson*, 541.
  Bulk of English trade, *Trengrouse*, 683-85, 693.
  Used chiefly by middle class, *Trengrouse*, 698.
  Decreasing demand because of pasteurisation, *Lovell*, 730.
  No difficulty of vending, *Hehner*, 5603.

BUTTER—*continued.*

13x. Irish : Supply :
  For English market expressly, *Sandes*, 113.
  Turns out a ton a week, *Sandes*, 123.
  Much shipped on chance of sale, *Dale*, 301.
  Much goes to London, *Dale*, 303-5.

13y. Uniformity :
  Demanded, *Dale*, 241-42, and secured, *Dale*, 245.

13z. Winter :
  Very little salt, less made, *Sandes*, 105.
  Quality not so good as grass butter, *Sandes*, 105.

14. CATTLE FOOD CAKES :
  Test samples contained borax purposely added, in cotton cake one lb. to a ton, to preserve colour. It might cover inferior make, and excess of mixture might lead to fermentative change. Such preservatised cake has not been adopted. Borax or formalin not used in the trade, *Voelcker*, 1687-90, 1709-11.

15. CHEESE :
  Skim milk made into, in summer, *McCracken*, 2910.

16. CLEANLINESS :

16a. Butter, Irish :
  Not enforced at nor proper inspection made of Irish farms: and creameries also need looking to, *Gibson*, 6404.
  Water supply to farms not looked to, 6678; but supply is good in North Ireland, *Lough*, 6679.

16b. Milk :
  Essential to the keeping of milk, *Long*, 4578.
  Four ounces of slime taken by heavy milk drinker per annum, *Long*, 4579, 4694-95.
  Dirt masked by preservatives, *Long*, 4671, 4695; which put a premium on good dairying, 4677.
  Absolute necessity, on which preservatives put a premium, *Tubb-Thomas*, 4936-38, 5027-32, 5039-40.
  Of milk churns ensured by treatment by Aylesbury Dairy Co. before return to farmers, *Hattersley*, 5786.
  Contracts of Manchester Pure Milk Supply Co. very stringent with farmers, and milk cans cleansed before return, *Sorensen*, 7060; and farm water supply looked to, 7061-63; and cooking of milk to 40 degrees insisted on, 7064; as requisite to a daily delivery, 7139-40. Price none the less lower than average vendor, 7064, 7158-60, *and footnote*. Milk is received in sealed churns, 7076-79.

16c. Milk, Preservatised :
  At a premium, *Jones*, 1309, 1362, 1365.
  Preservatives predispose to lack of cleanliness and sanitary precautions, *McFadyean*, 1753.
  Dirt, putrefaction, and infective quality of milk concealed, *Robinson*, 3312.
  Desirable to prevent bacterial activity by early addition of preservative, if allowed, *Foulerton*, 4053-57.
  Preservatives put a premium on cleanliness, *W. C. Williams*, 5306-7.
  Preservatives may enable cleanliness in milk trade to be dispensed with, *Brunton*, 7430.

16d. Preservatives :
  Use does not counterbalance uncleanliness; any premium placed on cleanliness to be deprecated, *Foulerton*, 4113-14, 4137.
  Likely to lead to neglect of cleanliness, *Corfield*, 4113.
  Cleanliness at a discount by their use, *Kaye*, 5454.
  Cloak for dirt, *Kaye*, 5519-20.
  Cleanliness may be discounted by their use in milk, *Dupré*, 5902-3. Guarantee of cleanliness lost when preservatives added to milk, 5905. Indeed, dirt is cloaked by such addition, 5942-47.

6. CLEANLINESS—*continued.*

16d. Preservatives—*continued.*
Uncleanliness of dairies arising from use of preservatives should be met by inspection, *Hutchison*, 6767.
Food preservatised may be dirty and contaminated and yet sterile, *Hope*, 6867-69.

17. COLD :

17a. A better preservative than drugs or minerals, *Hill*, 2500-1 ;
Preserving of food to be desired and waste prevented, *Hope*, 6822-23. Cold storage and chemical preservatives, two known means of preserving food, 6824. Copenhagen system of cold storage, 6624 ; not applicable here by reason of cost of ice and cost of inauguration, 6825. System failed in Liverpool ; doubtless it has had some success in Manchester, 6826. The Copenhagen plan is worked by block ice, 6827.
Limited application will keep milk sweet for some time, *Hope*, 6828.
Cold storage to be preferred to preservatives for food, *Halliburton*, 7530-32.

17b. Butter : Cold Store :
Used for overstock, *Hudson*, 548.
Butter never spoils, *Hudson*, 548.
In vogue for past five years, *Hudson*, 553.

17c. Butter, Australasian : Cold Storage :
Keeps it fresh and sweet, *Hudson*, 504.
Largely brought over, *Trengrouse*, 620, 623.
Used for stock more than a week old, *Trengrouse*, 665.
Keeps butter for nine months in full flavour with ½ per cent. of preservative, *Lovell*, 727.
Demands preservatives to prevent spoiling the defrosted butter, *Lovell*, 776, 778-81.
Used on arrival, *Lovell*, 802.
New Zealand butter comes in cold chambers with some salt, *Riley*, 830-1, 833.
Used for Australian butter, *Hill*, 2478.

17d. Butter, Irish : Cooling :
Cold storage non-existent in Ireland, *Gibson*, 6379 ; and price of ice there prohibitory of refrigerating plant for general use, 6380-84. Creameries have cooling tanks, not so the farms, 6401, and the milk travels long before cooling is accomplished, 6402-3.

17e. Milk : Cold Storage :
Suffices in place of preservatives, *Cassal*, 3804.
Necessary in very hot weather, and possible for small traders, *Cassal*, 3807-8, 3862.
Will keep milk fresh for some considerable time, say milk cooled to 40 degrees, *De Hailes*, 3917, 3950 ; many farms cannot cool to below 60 degrees, 3917. Many farmers have not got cold water, 3918–21, 3951–56. Some of London milk trade does not use preservative, 3922. Preservatives the only cheap method of safeguarding milk in view of absence of cold water at many farms, 3957–63. Cold storage would render preservatives in milk unnecessary to large communities, 4010 ; not so cooling of the milk, 4011. Aylesbury Dairy Co.'s procedure not known, 4012-15. Cold storage milk vendors are against the use of preservatives, 4031.

17f. Milk : Cooling :
Would suffice immediately after milking under all ordinary circumstances, *Cassal*, 3862.
Essential, *Carrington-Smith*, 4431. Apparatus of cold water tubing used, 4432. Some farmers do not command the needed water supply 4433 ; which is necessary to long distance milk transit, 4434. Cooling chambers should be used by the consignees, 4434-35. Railway vans should be such as to keep the milk cool, down to 60° F., 4435-39. Cooling of milk plus cleanliness keeps milk sweet during transit, 4504. Witness sieves milk three or four times and is particular as to cleanliness of cattle and sheds, 4505 ; and these have their effect on keeping power of milk, but cooling the most important factor, 4505. No difficulty in the way of all milk being sieved, 4507-14 ; but difficult to get it done, 4516. All dairy farmers ought to have a good water supply, 4517-20. Dairies, &c., Order ought to be enforced, 4526-27, 4531. Drought at times a difficulty as to water supply, 4528-30. Only cool water needed for refrigerating, 4531-34 ; even catch water suffices for witness, 4535-37 ; milk not coming in contact with it, 4538.
Cooling of milk well enables it to be kept 24 to 36 hours in hottest weather, *Carrington-Smith*, 4577 ; that is, cooled below 60° F., 4578. Milk kept at 60° F. for first 12 hours will keep 36 hours in all in hottest weather, 4582-84. Milk cooled from 55° to 60° F. kept 36 to 48 hours, being scalded in sultry weather, 4588-93. Imperfect cooling has led to return of milk to witness, 4611.
Should be effected, *Tubb-Thomas*, 5039-40.
Increasing in West Riding, *Kaye*, 5521-23.
On milking insisted on, by Aylesbury Dairy Company, *Hattersley*, 5781 ; as essential to its keeping, 5782, 5821-24 ; also straining, 5819. Water supply of farms traded with looked to as proper, 5827-31 ; also the sanitary condition of the farm, 5730, 5882-83, 5899-900. Cooling of milk only at fault once in 1899, 5732-34.
Cooling is relatively expensive, requiring ice, *Sorensen*, 7037 ; a commodity more easily obtainable here than is imagined, 7038 40, ; though difficulty may occur in parts, 7136-38. Ice preserved by stacking, 7041-42. Manchester supply from places comparatively near at hand, 7054-58. Milk sufficiently cool will travel 200 miles equally as well as 50 miles, 7058.
Cooling of milk, and storage at moderate temperature, of vast importance in relation with keeping power of milk, *Schidrowitz*, 7233 ; and would obviate need for preservatives, 7234. Lactic acid bacteria less resistent to preservatives than other bacteria, 7245-46. Should be enforced by Statute, 7235-37 ; under adequate inspection, 7238, 7242-44 ; though difficulty might arise as to enforcement, 7239-41. Initial cooling would allow of transit without material raising of temperature of milk, 7250 ; but refrigerator cars would be a great help, 7251. For cooling, 15° C. regarded as practically best, 7233, 7237, 7252-55. Maximum temperature of experimental milk in transit, uncooled, was 29·5° C., 7256-59 ; in milk cooled to 10·5° C., it was 11° C., 7260-61.
Cooling and sterilising would obviate need for preservatives probably, *Brunton*, 7444. Cooling the best known form of preserving milk, 7449-51. No bad results known or feared from refrigerated milk, 7452-55.

17g. Refrigeration :
Used, it may be, at times for preservatised milk, *Brierley*, 3181.
More expensive than borax packing for bacon, *Bannister*, 3488-94.
This and sterilisation proper methods of food preservation, though perhaps more expensive, *Cassal*, 3816.
Freezing of milk might cause infantile scurvy, *Still*, 6801 ; moderate cooling would not, 6802.
Not needed for large towns, *Hope*, 6897.

17h. Refrigeration : Bacon, American :
Unsatisfactory, *Sinclair*, 936-37.

17j. Refrigeration : Butter:
Butter keeps best if preservative also added, *Shanahan*, 381-84
Does not keep butter like butter only preservatised, *Clement*, 1508-10, 1546-47.
May serve to make kept butter dangerous *Clement*, 1547-51.
Butter decomposes readily on defrosting, *Bannister*, 3626-27.

18. CONTRA-INDICATION OF PRESERVATIVES:

18a. Boracic Acid:
- In kidney troubles, *Wild*, 1429; with albuminuria, *Wild*, 1447-50.
- In numerous persons, *Wild*, 1450-52, 1455-57.
- In certain conditions of stomach, especially of digestive organs of children, *Wild*, 1467-72.
- No practical experience as to pregnancy, *Wild*, 1473-78.
- In scarlet fever, with kidney disease, *Wild*, 1496-98.
- Not in small amount in milk in enteric fever, *Wild*, 1496.
- In many conditions, *Walford*, 1879-81.
- In pregnancy, *Walford*, 1882, 1884-85; action on uterus unknown, *Handford*, 2294; in pregnancy not known, but not disbelieved, *Bond*, 3157-62.
- In certain diseases, *Williams*, 2213.
- In nephritis, *Handford*, 2292-93.
- In fever, and always unless direct benefit expected, *Handford*, 2302-4.
- May be administered in all conditions, *Bell*, 2808-10.
- In kidney disease, in large doses, *Bond*, 3084, 3098.
- For irritable stomach, *Bond*, 3135-37, 3140-42.
- No wide prevalence of contra-indications, save, as to indigestion, *Bond*, 3144-46, 3148-54, 3156.
- Fatal termination of kidney disease might be hastened by indiscriminate use, *Bond*, 3147, 3150, 3155.
- All renal disease cases do not contra-indicate use, *Bond*, 3163.
- Physician should know if milk boracised in cases of albuminuria, *Bond*, 3164-66.
- Commonly in milk, including healthy persons, *Foulerton*, 4149-50.
- In typhoid fever and acute nephritis, of heavily boracised milk. Injury to individuals may result from indiscriminate use of boracic acid, *Stevenson*, 4810.
- Infants relatively more susceptible than adults, *Stevenson*, 4848-50.
- Of borax in kidney disease not a matter on which would like to express opinion, *Hutchison*, 6705. Effect on diseased kidney thought of as small, 6707. No information on the point, 6708. No specific effect in pregnancy known, 6709-11.
- Boracic acid contra-indicated and dangerous in any lesion or disease of intestinal tract, *Starling*, 6973. Dangerous to feed a typhoid patient on milk containing 20 grains of boracic acid per pint, 6974, or a diphtheria patient; both would take much milk, 6975-76.
- The acid is an irritant, and therefore bad in typhoid fever, *Anderson*, 7190. It is a very feeble antiseptic, 7191. Contra-indication of boracic acid in fevers, 7205-6; and in all disorders entailing milk diet, 7208. Would not give the acid in nephritis, 7209.
- Of borax in pregnancy, *Brunton*, 7463.

18b. Formaldehyde:
- Commonly in milk, including healthy persons, *Foulerton*, 4149-50.
- Infants relatively more susceptible than adults, *Stevenson*, 4848-50.

18c. Salicylic Acid:
- Kidney disease, *Bond*, 3108.
- In large number of persons, *Corfield*, 5104-12.
- Of salicylic acid in cardiac affections, *Hutchison*, 6737, and perhaps in acute nephritis, 6738. Probably dangerous in acute forms only of kidney diseae, 6739,
- Of salicylic acid in cardiac weakness, *Starling*, 6971, 6971.* Its indiscriminate use objected to, 6972.
- Indiscriminate use should not be permitted *Brunton*, 7464.

19. COOKING:

19a. Boracic Acid:
- Would not alter it, *Walford*, 1907-8.
- Would equably distribute it in milk, *Handford*, 2274.

19b. Formalin:
- Would alter it in food, *Walford*, 1918.

19c. Preservatives in Food:
- Does not affect, *Williams*, 2124-25.

20. COST OF PRESERVATIVES:
- Greater than salt, *Dale*, 252-54, 283. Infinitesimal per lb. of butter, 284-86.

21. COURT OF REFERENCE:
- Needed as to colourings and preservatives, *Blyth* 3407-9.
- Standing committee generally agreed upon as being useful, *Blyth*, 3410.
- Would be valuable as to both preservatives and colouring matters, *Stevenson*, 4851-53.
- Advocated, with specific declaration of preservatives as a basis of action as to legalisation of such preservatives, *Brunton*, 7437-38. Medical profession should be well represented on such a Board, especially the Royal College of Physicians, 7439. Board originally suggested by analysts, 7440; and analysts requisite to its constitution, 7441. Such a Board would result in the formulation of definite rules as to preservatives, 7443. Our present knowledge as to milk trade without preservatives, a case in point of present defective information, 7444; as also in regard of sterilisation of milk, 7445. The Board suggested might lead to the prohibition of preservatives, 7467.

22. CREAM:
- Increasingly in use for infants and invalids, *Handford*, 2278.
- Liable to change, *Bell*, 2838.
- Medical men now prescribe, in place of cod liver oil, *Cassal*, 3820.
- Keeps three days without preservative, *De Hailes*, 4034, 4036.
- Potted cream, for trade purposes, should keep a fortnight, *De Hailes*, 4035.
- More likely to sour than milk, but point not personally vouched for, *Carrington-Smith*, 4447-53.

23. CREAMERIES:

23a. Butter, Irish:
- Danish style general, *Dale*, 246.
- Danish style in some, *Shanahan*, 488.
- Preservatives not added by creamery suppliers, *Shanahan*, 486.
- Greatly improved, *Shanahan*, 387-88.
- Supplied once or twice a week, *Shanahan*, 457-59, 485.
- Creamery butter about one-seventh of Irish trade, *Gibson*, 6368-69.

23b. Creameries, Irish:
- Early one started in 1885 for butter making, *Sandes*, 77, 78.
- Creamery industry revolutionised of late years in Ireland, *Lough*, 6618; and very largely increased, 6619-20. Farmer waits for the separated milk, 6623; for feeding calves, 6624. Cleanliness is observed at the creameries as to milkers, cattle, utensils, storage of milk, and so on, 6677. Straining is insisted on, 6680

23c. Milk for Creamery: Source of Supply:
- Local, three miles distant at most, *Sandes*, 125.

24. CUMULATIVE PROPERTIES:

24a. Boracic Acid:
- Effect of doses cumulative, *Wild*, 1427.
- Nil, *Bell*, 2826.
- Disproved by Liebriech, pointed to by others, continued dosage tends to harm, *Blyth* 3469-71.

24. CUMULATIVE PROPERTIES—*continued.*

24a. Boracic Acid—*continued.*
In healthy cases no cumulative effects of boracic acid, *Starling*, 6977.
Element of uncertainty, *Brunton*, 7434-36.

24b. Preservatives:
Of preservatives, such as boracic acid, elements of uncertainty, *Brunton*, 7434-36.

25. DECLARATION:

25a. Boracic Acid (Simple):
Important and sufficient as to milk, *Wild*, 1436, 1444-46, 1453-55, 1488-92.
Would be useful to medical men, and lessen the sale of boracised milk, *Cameron*, 2581-82.
Not necessary in regard of food, and objected to, *Bell*, 2793, 2831-33.
Medical men should know if their patients are taking boracised food, *Blyth*, 3473.
Should be made, *Harris*, 6035; and would do away with present injustice to English bacon trade, 6036.
Borax should be notified, *Halliburton*, 7542-43.

25b. Boracic Acid (Specific):
Label desirable as to milk if possible, *Wild*, 1493-95; but would be difficult as to quantity, *Cameron*, 2580.
Nature and amount should be stated, *Bond* 3095-96, 3101, 3142

25c. Milk, Boracised:
Impracticable, *Handford*, 2275.

25d. Preservatives:
Should be made as to food, *Walford*, 1836; and would be useful as to coppered foods, *Cameron*, 2557, 2578.
Would not suffice, *Walford*, 1837, 1870-71.
Would suffice; but not where boracic acid is contra-indicated, *Vasey*, 2067-74.
If preservatives found to be injurious, should be made, *McCracken*, 3005-6.
Would not be objectionable, *Dunn*, 3019-20.
Proper course, *Bond*, 3075, 3167.
Fraught with difficulty as to milk, but might check amount used, *Brierley*, 3183-87.
Should be obligatory, *Robinson*, 3312.
Should be made; would safeguard food from repeated dosage; is preferable to labelling, *Blyth*, 3458-59, 3474-75.
Not objected to, *Bannister*, 3677.
Of composition of an article, should be made, *Cassal*, 3794; and compulsorily demanded if preservatives deemed necessary to cheapness of commodities, 3802; and should include nature and amount, 3858; and their probable effect, 3859-61; but less desired than prohibition, 3875. Practical difficulties in way of amounts being stated, 3878; and in precise determination of these amounts analytically, 3879-81; especially if a limiting value were insisted on, 3882-85; as to boracic acid, 3886; and more so as to formalin, 3887-98.
Should be made, if they are permitted, *Faber*, 4203-4.
Saccharine in wines and beer allowed in Denmark, only if declared on label, *Faber*, 4206.
The alternative to prohibition of preservatives; it would meet the case of idiosyncratic people, *Halliburton*, 7532-33. Borax should be notified, 7542; important to the public generally, 7543.

25e. Preservatives in Butter:
Not objected to, *Clement*, 1554-55; not necessary, 1557-59; not objected to, *Gibson*, 6352.
Simple declaration would not suffice, *McFadyean*, 1759; *Williams*, 2147, 2152-53, 2212-14.
Should be definite, *Williams*, 2140.

25f. Preservatives in Cream:
Should be obligatory, *Voelcker*, 1716, 1749.
The alternative to prohibition, *Voelcker*, 1749.

DECLARATION—*continued.*

25g. Preservatives in Food:
Of articles as preservatised should be made, if preservatives allowed, *Long*, 4689.
Of preservatives should be made in some cases, *Fisher*, 4726; as in milk if permitted, 4728. No resolution passed by Society of Public Analysts, 4744. Declaration of milk as formaldehysed would not guarantee against a harmful dose, 4761.
Of preservatives should be made, *Blackwell*, 4874, 4897, and nature, 4899; and amount, 4900.
Of preservatives not desirable, rather to be avoided, *Tubb-Thomas*, 4949; and not sufficient *quâ* children and invalids, 5017-20.
Of butter as preservatised not objected to, but country of origin might suffice, *Cameron*, 6211-13, 6243-46.
Advisable, *Grünbaum*, 6480.
Of preservatives not objected to if and so far as practicable, *Attfield*, 6547.
Of preservatives, amount and nature and date of addition should be made in all cases, *Hope*, 6867.
Should be made of pasteurisation equally with preservatisation, *Poore*, 7367. All preservatives should be declared, 7377-79, 7381-82, 7386-89, 7391; and the amount of salt, 7380. No difficulty felt as to labelling, 7390.

25h. Preservatives in Milk:
Should be obligatory, *Voelcker*, 1716, 1749.
Should be definite, *Williams*, 2140.
Simple, would not suffice, *Williams*, 2147, 2152-53, 2212-14.
Warning notices circulated or posted would not avail much in Co. Glamorgan, *Williams*, 2154-68.
As to quantity, as indeed in all foods, should be made, *Hill*, 2522.
Not impracticable, and would solve many difficulties, with no great onus on local authority, *Boyce*, 2764-68.
Components of mixture should be declared, *Boyce*, 2770, 2773, 2776.
Not objected to, *Bannister*, 3549.
Difficult as to amount for several reasons, *Bannister*, 3550-53, 3558, 3628-30.
Would tend to limit amount used, *Bannister*, 3556.
Would not obviate risks attending partial admixtures, *Bannister*, 3635.
Eighty grains per pint should be declared, *Bannister*, 3639.
Should be made, *Rideal*, 3693.
Of preservatives in milk impossible and objected to, *De Hailes*, 3932-35. Not aware of system in United States, 3936-37; and notice to all customers impracticable, 3938, as also with butter, 3941-43. Labelling impracticable, 4001; and if declaration were alternative to prohibition, the latter would have to be enforced, 4002.
Should be made of preservatives in milk, to safeguard infants and invalids, *Foulerton*, 4047. Desirable from public health point of view, 4065. Trade interests should not stand in the way, 4,066. Exact nature or amount need not be declared if officially fixed, 4067. Declaration favoured rather than prohibition, 4076.

25j. Salicylic Acid:
Should be made of nature and amount, *Bond*, 3109.
Would like to know when he was taking it, *Robinson*, 3341.
Of salicylic acid a matter of importance to patients taking it as a drug, *Brunton*, 7464. Amount should be stated, 7470.

26. DECOMPOSITION OF FOOD:

26a. Boracic Acid:
May be concealed thereby, *Walford*, 1846; and disguised in milk, *Handford*, 2278,
Danger from use of boracised fish unfit for sale, *Handford*, 2278.
Abnormal decomposition prevented by 10 to 15 grains thrice daily, *Attfield*, 6497.

26. DECOMPOSITION OF FOOD—*continued.*

26b. BUTTER : Preservatised :
  Putrefaction not arrested thereby, *Shanahan*, 483-84.

26c. PUTREFACTION OF FOOD :
  Ill-effects caused, *Jones*, 1328-30, 1336.

26d. MILK :
  Innocuous quality not known, *Williams*, 2201-3.
  Whether partly decomposed milk better by reason of preservatives not known, *Williams*, 2242-44.
  Danger would arise in the case of old milk preservatised, *Hill*, 2409.
  Incipient harmful changes not perceptible to taste or smell, *Hill*, 2467-69.
  Acidity as a full indication, not known, *Annett*, 2683-84.
  Arrested only by pasteurisation, *Bell*, 2841.
  Danger, *quâ* infantile mortality, diarrhœa, and wasting, *Bannister*, 3654-55.
  Acidity of milk and organic growth rapidly take place, *Rideal*, 3698.

26e. MILK : Boracised :
  Sourness not done away with, *Williams*, 2187-90.
  Putrid milk more harmful than if sweet and moderately boracised ; but such putrid milk would not be purchased, *Handford*, 2306.
  Putridity would be checked and veiled by boracic acid, *Handford*, 2307-8, 2319.
  Injurious products may be formed, *Mann*, 2605, 2612.
  Veiling, unlikely, *Annett*, 2686-88.

26f. MILK : Preservatised :
  Does happen, *Voelcker*, 1698-1701.
  When commenced could hardly be veiled by preservatives. *Voelcker*, 1712-13.
  Milk a good ground for bacterial growth, *McFadyean*, 1761.
  Not found, *Walford*, 1914.
  Danger of decomposed milk being sold if preservatised, *Williams*, 2112.
  Partly decomposed milk most frequently preservatised, *Williams*, 2182.
  Lactic changes retarded, and others not retarded by preservatives, *Brierley*, 3253-54.
  Preservatives not thought of as likely to veil decomposition in milk, *Hutchison*, 6717-18.
  Sterility of milk claimed as regards milk rendered sterile by chemical preservatives, a false claim, *Hope*, 6870-75.

26g. MILK : Sour :
  Slightly, is drunk by people, *Hill*, 2471.
  Injurious to infants, *Annett*, 2685.
  Probably more harmful than boracised milk, *Bannister*, 3546.
  Danger, *quâ* infantile mortality, diarrhœa and wasting, *Bannister*, 3654-55.
  Change of milk detected by taste and smell, *Foulerton*, 4092-95.
  Exact composition of sour milk not known, *Foulerton*, 4096-98.
  Lactic change not due to any one bacillus, though lactic acid primarily in question ; no taste could discriminate below 0·4 per cent. of lactic acid, *Foulerton*, 4099-4106, 4182-84.
  Sourness of milk the essential test of its injuriousness, *Blaxall*, 6102-6 ; but a poor test of other changes going on in milk, 6137 ; but smell distinguishes nearly all harmful lactic changes, 6138-39.

27. DIARRHŒA :
  Most prevalent during hot months, when preservatives presumably most in use, *Walford*, 1890-92.
  Poor people most liable to, and also to get boracised milk, *Hill*, 2377-80.
  Several causes can always be found, *Hill*, 2444.
  Increases in the ratio of poverty, and among the class getting most preservatised milk, *Hill*, 2450-51.

27. DIARRHŒA—*continued.*
  Increasingly prevalent in Leeds, despite measures adopted ; most prevalent in autumn, when preservatised milk most used, chiefly by poorer classes, *Cameron*, 2539, 2574-76, 2586.
  Association with preservatives not known, *Corfield*, 5128-32.
  Moderate use of preservatives to be thought of as lessening risk of diarrhœa by bad milk, *Hutchison*, 6769. Diarrhœa not attributed to boracic acid in milk, 6770, rather to lack of sufficient preservative to keep milk from going bad, 6771 All diarrhœa in children not due to bad milk, 6772-73. Diarrhœa should be decreasing by use of preservatives, 6782. Not known if it be so, 6783.

27a. BORACIC ACID.
  Results from 120 grains taken in four hours, *Wild*, 1418.
  In certain children taking 7½ grains per pint of milk, *Wild*, 1480.
  Probably kept up by boracised milk, *Walford*, 1889-93.
  In a child, held to be related to boracised milk, *Handford*, 2267-73, 2314-15.
  Relationship thought of, but not studied or traced ; investigation a matter of difficulty, *Hill*, 2374-76, 2445-49.
  Diarrhœa in children found to get worse when treated with 1 to 5 grains of boracic acid in their food, *Tubb-Thomas*, 4926, in Newport (Mon.), 4927, an industrial town · the milk ordinarily taken by the children containing from 40 to 120 and more grains of boracic acid per gallon, 2928, as ascertained by analysis and by the word of the milk vendors, 4929, who added the acid under a fancy name, 4930. Many children in question, 5001, at all seasons, 5050, for 12 months, 5051, in one locality, 5002 ; no multiple attacks in houses, 5003. Milk drinkers alone attacked, 5004, 5008, and all milk from one source, 5005, 5007, which hit all children alike, 5006. Other similar experiences had, 5052-54. Diarrhœa rate among children thought of as influenced by preservatives, 5009-10. The disease induced in phthisical persons on boracised-milk diet, 5024-25. Doubtless the experience recorded above regarded as exceptional because of want of knowledge on part of medical profession, 5055-56. Boracic acid, salicylic acid, formic aldehyde prescribed by witness for diarrhœa and indigestion, 5056, but not since above experience, 5058, as no control can be had over the doses taken, 5059-61.

27b. DIET :
  Milk diet and diarrhœa closely related, *Walford*, 1897.

27c. INFANTILE :
  Not specially studied, *Williams*, 2216.
  Mortality of infants in third quarter of the year put down in part to large use of preservatised milk during the hot months, *Kaye*, 5466-72. Infantile diarrhœa mortality always excessive in third quarter, 5474-76, 5481, and preservatised milk thought of as a factor in preventing fall in such third quarter mortality, 5477-78, 5484, but some improvement to be looked for as regards towns purveying unpreservatised milk if thesis be true, 5485-88 ; but some cause operating prior to use of preservatives, 5482-83, and perhaps decomposed milk, 5484, 5492. Diarrhœa may be produced by changes in milk resulting from contained preservatives, 5493-94. Tinned milks not regarded as a prime factor, 5535-37, but they play their part, 5538-42. Diarrhœa caused by borax administered as a drug to children, 5503-4. Dosage not known, 5505. Conditions surrounding child-life tend to diarrhœa specially in the third quarter, 5543-46. Boracic acid a greater cause than tabes mesenterica, 5553-56. Diarrhœa mortality curves of Continental cities vending unpreservatised milk tend to show lower infantile rate, 5557-58.

27. DIARRHŒA—*continued.*

27c. INFANTILE—*continued.*
  - Milk well cared for in Great Ormond Street Hospital, but two epidemics of diarrhœa definitely traced to bad milk there in summer, *Still*, 6790.
  - In relation with preservatives, not traced, *Hope*, 6922.

27d. MILK, BORACISED :
  - Some suspicion attaches to boracised milk, *Cameron*, 2539, 2573, 2577, 2585 ; *Mann*, 2605-7, 2628 ; *Robinson*, 3332-34.

27e. MILK, PRESERVATISED :
  - Regarded as persistent by reason of preservatised milk, but cases not known of, *Williams*, 2171-76, 2191-92, 2224-25.
  - Diarrhœa mortality in infants probably related to preservatised milk, *Annett*, 2675-80.
  - Some diarrhœa doubtless due thereto, *Bannister*, 3655-57.

27f. SANITATION :
  - Ought to have reduced mortality beyond its present rate, *Walford*, 1895-96.

28. DOSES :

28a. BORACIC ACID :
  - Personally 10-grain doses have no effect, *Wild*, 1416-17.
  - Doses of 15 to 20 grains not injurious singly, *Wild*, 1417.
  - Daily doses for a week of 15 to 20 grains create slight disturbances, which cease on omission of the acid, *Wild*, 1418.
  - In health and sickness, from 10 to 80 grains a day found to be beneficial, *Wild*, 1421.
  - In $\frac{1}{1000}$ in milk, baby would get a large hurtful dose daily, *Wild*, 1430-35 ; might get an over-dose, *Robinson*, 3338.
  - In $\frac{1}{1000}$ would be 9 grains per pint of milk, *Wild*, 1433.
  - For a child some three grains, *Walford*, 1876.
  - Sixty grains in food, and the same medicinally daily, objectionable for an adult, and a danger, *Walford*, 1877-78.
  - Much exceeded in milk, especially for children, *Williams*, 2206-11.
  - From 5 to 15 grains in Pharmacopœia, *Williams*, 2204-5.
  - From 10 to 15 grains, adult, and 1 to 1½ grain, infant, *Handford*, 2270.
  - More than a maximum dose might be taken in food in a day in Birmingham by a patient taking also a medicinal dose, *Hill*, 2458-59.
  - Infants might take a full dose in milk, *Cameron*, 2536.
  - Reason for reduction in Pharmacopœia not known, *Bell*, 2803-4.
  - Ten grains suffice to produce a medicinal effect, that is, 30 grains a day, *Bell*, 2805-7.
  - Fifty grains absurd and unnecessary for an adult, *Bell*, 2813, 2815.
  - Would not give a child 40 grains, *Bell*, 2816.
  - Ten grains given to hundreds of patients, *Bond*, 3064.
  - Usually 30 grains per diem, *Bond*, 3066.
  - Gives grain doses to children in diarrhœa, *Bond*, 3071, 3073.
  - Child, one-fifth that of an adult, *Bond*, 3076-78.
  - From two to three grains for child of five years, but more not dangerous, *Bond*, 3080-81.
  - Forty grains a day limit for adult, *Bond*, 3079.
  - Danger limit unknown, *Bond*, 3082.
  - Child might take too large a dose in milk, *Bond*, 3090-93 ; in $\frac{1}{1000}$, *Robinson*, 3338.
  - Experiments by large dosage of individuals discounted by idiosyncrasy, *Robinson*, 3339.
  - No one should have more than 15 grains daily under any circumstances, *Stevenson*, 4834-36.
  - Reduced 50 per cent. in new edition of Pharmacopœia, *Tubb-Thomas*, 5062 ; *Corfield*, 5090.
  - Probably only a certain quantity can be voided daily, and any larger dosage undesirable, *Corfield*, 5075, 5080.

28. DOSES—*continued.*

28a. BORACIC ACID—*continued.*
  - Over dosage likely, *Corfield*, 5082.
  - Boracic acid taken, from 10 to 15 grains thrice daily, as sufficing to prevent abnormal stomachic decomposition of food, *Attfield*, 6497 ; but larger doses have been taken, though 10 grains found sufficient, 6497-98. As much as 70 grains daily taken experimentally, 6499. No inconvenience resulted, 6500.
  - Reduced in Pharmacopœia because present dosage produces all needed effects, *Attfield*, 6533-35, and larger doses do no more, 6536. Has taken 100 grains in one day, 6537 ; and has kept up 45 grains daily for weeks, 6538. Desirable to know the quantity of boracic acid being taken with food, 6557 ; but matter not of great importance, 6558-59.
  - Would not like to take 80 grains as a dose, 6713 ; even with a pint of milk, *Hutchison*, 6714.

28b. SALICYLIC ACID :
  - Usually 30 grains daily, *Bond*, 3130-31.
  - Salicylic acid may be taken from 5 to 15 grains at a time, without retarding digestion, *Attfield*, 6568.

29. DRUGS :
  - Not defined by statute in relation to foods, *Cassal*, 3789-94.
  - Substance of a poisonous character, or having active character as a drug, should not be used in food, *Cassal*, 3794.
  - Objectionable as preservatives, *Hehner*, 5637-38.

30. EGG POWDERS :
  - Egg powders are baking powders, one such powder is prepared with dried egg, *Hope*, 6853 ; some are not egg powders at all, yet are used by some persons as food for children, 6854, 6859-62. Some labelled as not made from eggs, 6855 ; as the result of a prosecution, 6856-58. Powders are coloured to simulate egg-colouring, 6863, 6865-66. Egg powders looked upon by vendors as naturally eggless, 6864.

31. EXPERIMENTS :
  - In and outside human body not on the same plane, *Cassal*, 3872.
  - Home Office licence necessary in the case of animals, *Stevenson*, 4820.
  - Evidence not decisive nor satisfactory thus far, *Tubb-Thomas*, 5000, 5063-66.
  - On animals not of very much importance, *Corfield*, 5115. Results should not decide a matter, 5116, 5120 ; such as dosing children with drugs, 5117-18. Known action of the drugs on the human economy is the point of importance, 5121 ; and avoidance in the absence of such knowledge advocated, 5122.
  - On animals valuable on certain defined lines, monkeys being preferred to cats or dogs, *Grünbaum*, 6482 ; and with positive results as to preservatives, 6488-90. But weight for weight and age for age, animals stand unnatural food better than the human, 6482-83. Pig said to approximate to man in structure, 6484-87.
  - *In vitro* not deemed important, *Still*, 6818-20.
  - With artificial gastric juice are reliable, but harder on the antiseptic than those on the living subject, *Starling*, 6988-91.

31a. ANIMALS, ADULT :
  - Animals used by Rideal and Foulerton too old, *Boyce*, 2726.
  - Feeding of animals with formaldehysed food has no effect on the nutrition of cats, guinea-pigs, or rabbits, *Rideal*, 3687.
  - One animal fed first on formaldehysed and later on boracised milk gained considerably in weight, *Rideal*, 3689-90.
  - Committee should undertake, *Stevenson*, 4855-56.

31b. ANIMALS, YOUNG :
  - Preferable to adult animals and *in vitro*, *Annett*, 2673-74.

31. EXPERIMENTS—*continued.*

31b. ANIMALS, YOUNG—*continued.*
  Certain rodents susceptible to diseases affecting the human, to which cats and dogs are not susceptible, *Boyce*, 2718.
  Committee should undertake experiments as to effect of preservatives on young animals, such as monkeys, but rate of mortality among the latter a point of objection to their use, *Stevenson*, 4811-19. Such experiments are needed and Committee should undertake them, 4846-47, 4855-56.

31c. BORACIC ACID:
  On digestion, in foods, *Cripps*, 1936-67.
  Less powerful as a germicide and antiseptic than formalin, *Blaxall*, 6061, 6094, and also as a preservative, 6067-69. Boracic acid up to $\frac{1}{33}$ will not sterilise milk, 6062; fermentation ceases, but organisms grow freely, 6064, 6129. Milk will only take up about $\frac{1}{25}$, 6063. In $\frac{1}{200}$ milk sours in 24 hours at 80° F., 6064-65. In $\frac{1}{2000}$ no effect in keeping milk sweet during summer weather, 6096-98; and would not prevent formation of lactic acid, 6099-101; but $\frac{1}{200}$, an undesirable amount, would keep milk sweet for 24 hours at 70° F., 6108. About $\frac{1}{100}$ or five grammes per pint will produce inhibitive action in milk, 6127-29. A proportion altogether in excess of the Pharmacopœial dose requisite to keep milk sweet, 6130. Inhibitive action of boracic acid apart from milk not experimented on, 6131-32.
  Liebriech's pamphlet on the action of borax thought of as biassed, *Halliburton*, 7558-64. Boracic acid least harmful of preservatives, 7578-79. Experiments of Foster and Chittenden known; latter shows boracic acid as innocuous in certain quantities in the case of dogs, 7591-94.

31d. CATS:
  Cats are carnivorous, *Boyce*, 2715.
  Commonly made, *Boyce*, 2717.
  Cats sometimes affected by tuberculosis, *Boyce*, 2719.
  Of little value as compared with the human economy, *Tubb-Thomas*, 5067-69.

31e. DOGS:
  Almost worthless, *Boyce*, 2713.
  Commonly made, *Boyce*, 2717.
  Dogs sometimes affected by tuberculosis, *Boyce*, 2719.
  Of little value as compared with the human economy, *Tubb-Thomas*, 4993-96.
  Economy of dog more resistant than that of man, *Halliburton*, 7565-66; metabolic processes of dog and puppy much the same, but diet varies, 7567-68.

31f. DOGS: Boracic Acid:
  Chittenden's experiments made on full grown dogs, and hence differ in results from Annett's on kittens, *Annett*, 2664.
  On dogs do not show much against boracic acid or borax as used in foods, *Starling*, 6944.
  Chittenden shows boracic acid to be innocuous in certain quantities in the case of dogs, *Halliburton*, 7591-94.

31g. FEEDING:
  If systematic, would be important, *Walford*, 1899-1900.
  Meagre on Continent, *Boyce*, 2729-30, 2739-41 (footnote).
  Proceeding in Berlin, as to boracic acid, *Boyce*, 2730.

31h. FORMALDEHYDE:
  Strength of $\frac{1}{10000}$ used, *Cassal*, 3834.
  Resulting demonstrations of small effect of use of formic aldehyde as evidenced by Dr. Rideal's experiments, not known, *Foulerton*, 4077-81.
  Fish died in a few hours when subjected to $\frac{1}{20000}$ formic aldehyde; $\frac{1}{10000}$ had no effect on action of frog's heart, *Foulerton*, 4138, 4141, 4163-66.

31. EXPERIMENTS—*continued.*

31h. FORMALDEHYDE—*continued.*
  Experimental work done as to preservatives in food, *Blaxall*, 6044; as to sterilisation of milk by formalin, 6045. Age of milks used in experiments not known, but deemed of recent milking, 6066, but element of uncertainty in results, herefrom, 6085. Experiments made on scientific basis, not from a commercial standpoint, 6071-73. Commercial usage of preservatives not known, 6074-76. Experiments made from May up to and during winter, 6115, all milks tested for formalin, but not all for boracic acid or salicylic acid, 6053, 6116-18, and no reason to suspect their presence, 6118-25. Bacilli in experimental milk not differentiated, 6126.
  Formalin in $\frac{1}{500}$ kills all germs in milk, which latter can be kept indefinitely, *Blaxall*, 6046-51. Method of procedure adopted, 6052-54. Thirty-eight experiments made, 6059. Control unpreservatised milks nearly all went sour in 24 hours, in hermetically sealed flasks, 6055. Sour milk preservatised had as many organisms as the control milk; but sweet milk, not so, 6056. Bacteriological fermentation not seasonally different under the conditions of the experiments, 6057-58. Formalin $\frac{1}{10000}$ will keep milk sweet for a short time, 6078, possibly 24 hours at 60° F., 6079, not at 80° F., 6080-82, the 24 hours being it may be from 36 to 50 hours after milking, 6083-84. In $\frac{1}{50000}$ formalin no use for keeping milk 24 hours in summer weather, 6086-91, 6095, 6098, and would not prevent formation of lactic acid, 6099-101, but $\frac{1}{5000}$ would keep it for 24 hours at 70° F., 6107. Specific action of formaldehyde on the constituents of milk not known, 6092-93. Formalin of experiment guaranteed as a 40 per cent. solution but not tested, 6112-14. About $\frac{1}{7000}$ would kill typhoid bacilli, 6142, and $\frac{1}{500}$ any bacteriological organisms in milk, 6146, and render milk unsaleable, 6151. Formalin hardens sections, 6143-44. Organisms in milk diminish rapidly on addition of formalin, 6147-48. Volatile nature of formalin not known, 6149-50.
  Experiments made as to physiological action of formalin, *Starling*, 6938; with formalin in $\frac{1}{2000}$, 6960-62. Experiments of Drs. Rideal and Foulerton as to formalin not known, 6957-59.

31j. GUINEA PIGS:
  Almost worthless, *Boyce*, 2713.

31k. KITTENS:
  On young kittens important, *Boyce*, 2713.
  Digestion resembles the human, *Boyce*, 2714.
  Food approximates to that of infant, *Annett*, 2668; *Boyce*, 2716.
  Difficult to feed successfully: some kittens fed on formaldehysed milk, $\frac{1}{50000}$, and boracised milk, $\frac{1}{2000}$, and taking 70 c.c. of milk per diem, increased in weight, *Rideal*, 3688-89.
  Dr. Annett's experiments on boracised kittens of value, and should be carried on upon a larger scale, *Stevenson*, 4805.
  Kittens approximate more nearly to the human than cats and dogs, *Tubb-Thomas* 4996-99.
  Demonstrate harm by boracised and formalised milk, *Hope*, 6830.
  Experiments of Dr. Annett not known, as to boracised kittens, *Halliburton*, 7569-70.

31l. KITTENS: Boracic Acid:
  Feeding with 80 and also 40 grains per gallon of milk, led to emaciation and death, *Annett*, 2647; kittens had diarrhœa, 2648; probably voided balance of unassimilated nutriment, 2649. Control kittens used, 2650. Amount of boracic acid taken not known, 2653-55, 2690. Ten boracised kittens took about a quart of milk daily, 2656-59. Kittens hardly susceptible to boracic acid after three months old, 2660, 2662, 2671-72, 2694, 2704. Susceptibility decreases gradu-

31. EXPERIMENTS—*continued.*

31l. Kittens : Boracic Acid—*continued.*
ally, 2695, 2698-2701. *Vice versâ* experiments on kittens not attempted, 2660-61. Relative immunity of infants not known, 2696. Older kittens used by Rideal and Foulerton led to different results, 2663, 2691-93. No experiments on kittens fed normally till three months old ; Foulerton obtained no results with kittens so old, 2703, 2705 ; kittens, like infants, depend on milk diet, 2668.
Boracised milk not so appetising as undoctored milk, *Boyce*, 2721-22, 2727-28.
Of little worth, *quâ* human analogy, *Bond*, 3103-4.

31m. Kittens : Formaldehyde :
Growth retarded if used in milk $\frac{1}{50000}$; greater retardation in $\frac{1}{25000}$, and still greater in $\frac{1}{12500}$, *Annett*, 2640-41.
Formaldehysed milk not so appetising as undoctored milk, *Boyce*, 2720.

31n. Kittens : Preservatised Milk :
Continued dosage tends to immunity, and natural immunity comes on about three months of age, *Boyce*, 2731.

31o. Laboratory :
Do not typify human conditions, *Walford*, 1865-66, 1898.
Outside human body, not generally of much account, *Cripps*, 1955.
As to injurious results of preservatives in food must be long-continued to be conclusive, as in the case of water-borne lead poisoning, *Mann*, 2611.

31p. Salicylic Acid :
Experiments made with salicylic acid showed retarding effect on digestion of boiled white of egg, but not on pancreatic digestion, *W. C. Williams*, 5196.
As to digestive action, *Starling*, 6938.

32. FACTORIES :

32a. Butter, Irish :
Normandy style general, *Dale*, 246 ; *Shanahan*, 488.
Processes described, *Shanahan*, 350.
Butter of different farms blended, *Shanahan*, 367-68.
System greatly improved, *Shanahan*, 387-88.
Butter milk and water expressed, *Shanahan*, 351.
Supplied once or twice a week, *Shanahan*, 457-59, 488.
Send butter to London, preservatised, *Hudson*, 495-96.
Make secondary quality, with salt and preservatives, *Riley*, 820.
Factory and creamery butter not discriminated, *Long*, 4645-47.
Factory butter not touched at creameries, *Lough*, 6642. A source of annoyance to creameries, and often sold as creamery butter, 6643. It is not creamery butter, 6644. It is different from, 6645 ; and inferior to creamery butter, 6646. Irish and Normandy factory butters of very different class, greatly in favour of the latter, 6647.

33. FISH, PRESERVATISED :
When unfit for food, rendered saleable by use of boracic acid, *Handford*, 2278.
Crosse and Blackwell use no preservatives in potted fish, *Blackwell*, 4868-70.
Should not be preservatised, *Dupré*, 5907-12.
Boracising of fish given up, *Hope*, 6915 ; because flavour was destroyed, 6916. Boracising of oysters not known, 6919. Oysters having 38 grains of boracic acid to the lb. objected to, 6920-21.
Formalin heard of as used for fish, *Hope*, 6917 ; but not inquired about, 6918.
Fraud goes on as to so-called "smoked" food, *Poore*, 7383-85. "Smoked herrings" painted with pyroligneous acid 7385

34. FLAVOUR :

34a. Boracic Acid :
Nearly tasteless, *Williams*, 2139.
Eighty grains per pint would taste milk, *Bannister*, 3637-38, 3640.
To taste a food, must be present in excessive amount, *Stevenson*, 4832.
Has no aroma, *Harris*, 6004-6.
Has no flavour, *Attfield*, 6551.

34b. Borax : Butter :
Unpleasant in excess, *Kellitt*, 43.
Heavy quantity would lead to rejection, *Bennett*, 211-13, 216-17, 228-31.
Heavy quantity needed to produce aroma, *Bennett*, 215, 218.

34c. Borax : Meat :
Would taste meat if amount used were appreciable, *Bennett*, 150.
Injection into meat would impart flavour, *Bennett*, 192.
People would not eat flavoured hams, *Davidson*, 1591.

34d. Borax and Boracic Acid : Butter :
Distinct, *Clement*, 1519.
Boracised butter used for cooking (say) fish would tend to saponify the fat, *W. C. Williams*, 5232-42.
Tastes butter, and public taste is getting seasoned to it, *Hehner*, 5605.
Boracic acid in 1 per cent. solution tastes butter, *Sorensen*, 7125-28, 7146-50. Two per cent. would render butter useless for this reason, 7161-63.

34e. Butter :
Soil, vegetation, or food generally does not affect flavour of butter ; but the bacterial life does, *Faber*, 4296-99, and pasteurisation obviates all "feed taste," 4300. Flavour is produced by fermentation, 4304-5, 4308, not by breed of cattle, 4306-7, 4333.

34f. Butter, Irish :
Flavour of salt preservatised butter milder than such butter without preservative, *Gibson*, 6356.

35. FLUORIDES IN FOOD :
Heard of, but not found, *Vasey*, 2044-45.

36. FLYBLOW :

36a. Bacon :
Prevented by borax, *Kellitt*, 11, 12, 23 ; *Prossor*, 567 ; *Gregson*, 873, 881-82.
Used to cause loss in summer, *Kellitt*, 41.
Rarely seen now, *Kellitt*, 41.
Only seen where meat is moist, *Kellitt*, 41.
Occurs after cure, *Gregson*, 919-20.

37. FOOD :

37a. Assimilation :
Remains in the stomach some two or three hours, *Cameron*, 2562.

37b. Classification :
Desirable and feasible, *quâ* use of preservatives, *Vasey*, 2002-3, 2050, 2059-64.

38. FOODS, FRESH :

38a. Butter :
Vastly different to salt, *Clement*, 1556.
For immediate use not preservatised, *Clement*, 1526.
Is unsalted in the trade, *Clement*, 1560-71, 1573-79, 1581-82 ; *Hill*, 2507.
May be months old, *Hill*, 2508-14 ; if preservatised, *Clement*, 1572.
Not necessarily fresh made, *Clement*, 1576-80, 1583.
From Dunragit is fresh, saltless, and quickly consumed, *McCracken*, 2854-55.
Danish so-called in England ; in Scotland fresh butter is saltless and unpreservatised. *McCracken*, 2861.
Must now be absolutely so, *McCracken*, 2951.
Danish butter, containing 1 per cent. of salt, does not compete with "fresh" butter, *McCracken*, 2952-53.

38. FOODS, FRESH—*continued.*

38a. BUTTER—*continued.*
- Slightly salted butter is "fresh" on the market, *Long*, 4642.
- Bulk goes to better class; demand for saltless butter may have to do with use of preservatives, *Hehner*, 5596-5600.
- Aylesbury Dairy Company's fresh butter sales increasing, *Hattersley*, 5837. Company's sale doubled in five years, 5838 Why, not known, 5839-40.

38b. FOOD:
- Fresh food most important, *Poore*, 7346-47; and productive of energy, as instanced by animal life, 7350-60; and preservatised food different from fresh food, 7348-49. There should be no confusion between fresh and preserved foods; even frozen meat loses its flavour, and a great deal becomes flabby and unappetising, 7361. Salt meat speaks for itself, 7362; whilst preservatised and preserved foods do not, 7363. People should be able to get fresh food, 7373; and should use it in due proportion, 7376. It should be produced near centres of population, 7418. Preserved food inevitable, 7374; and demanding its place in dietaries. Best mode of preservation should therefore be adopted, 7375. Fresh and preserved foods should be differentiated, 7391-93. Preservatives may deceive on this point, 7383-85, 7412-13. Nutrition much to do with susceptibility to fatal disease, 7394-97.

38c. MEAT:
- Imported, not preservatised, but mildly cured on arrival in brine only, *Davidson*, 1632-34.
- Dusted with borax, *Handford*, 2280; if kept, *Bannister*, 3626.
- Imported in refrigerators, *Bannister*, 3487.

38d. MILK:
- Is recently from the cow, and unpreservatised, *Hill*, 2502-4.
- To restrict, as fresh milk, the sale of milk not fresh would be a hardship on distant milk-service vendors, *Cassal*, 3939-40.
- Boracised milk held to be "fresh," *De Hailes*, 3970-71.
- Almost impossible for London poor to get it at present, *Foulerton*, 4058-59.
- New and unadulterated, seldom preservatised, in Liverpool, *W. C. Williams*, 5149, 5155.
- Milk preservatised soon ceases to be fresh milk, *Poore*, 7349. Advantage gained if milk kept from going putrid, 7364; or if germ growth be inhibited; but milk treated for the consumer is not like the milk as drawn from the udder, 7365, 7420. A great thing to give people wholesome milk, 7420. Modern conditions among the poor for keeping milk very bad, 7419.

38e. PROVISIONS:
- Use now general, *Kellitt*, 56.

39. FRUITS, BOTTLED:
- Sterilised by Messrs. Keiller, *Boseley*, 1062; Messrs. Keiller do not colour, *Boseley*, 1148-51.
- Made without preservatives, but colour goes off somewhat, *Long*, 4664.

40. GERMICIDAL POWER:

40a. ANTISEPTICS:
- Have some selective action on bacteria, *Cameron*, 2564-72.
- Antiseptics not necessarily destructive of all bacteria, *Womack*, 7487-88.

40b. BORACIC ACID:
- Would lose restraining power if milk diluted, *McFadyean*, 1772.
- Does not remove signs of putrefaction, *McFadyean*, 1767.
- Feeble, but restraining, *McFadyean*, 1772.
- Micro-organisms found to have multiplied in boracised milk, *Mann*, 2613-16.
- Would scarcely inhibit growth of bacillus coli communis and enteritidis sporogenes in milk, *Boyce*, 2750.

40 GERMICIDAL POWER—*continued.*

40b. BORACIC ACID—*continued.*
- On certain bacteria, inhibitory rather than destructive, *Foulerton*, 4195-97.
- Not a germicide rather an antiseptic, *Richmond*, 5742-43.
- Borax a more efficient antiseptic than boracic acid, *Halliburton*, 7548.

40c. FORMALIN:
- Would scarcely inhibit growth of bacillus coli communis, or enteritidis sporogenes, milk, *Boyce*, 2750.
- On certain bacteria, inhibitory rather than destructive, *Foulerton*, 4195-97.
- A marvellous antiseptic, *Halliburton*, 7548.

40d. PRESERVATIVES:
- Restraint must be attained, if use effective, *McFadyean*, 1782.
- No experiments made as to bacterial growth in preservatised milk, *Boyce*, 2747-48.
- Preservatives' antiseptic power in relation to toxic equivalents not known, *Blaxall*, 6109-10; but important, 6111. Preservatives have a selective action on organisms in milk, 6133-36.
- Germicidal power of preservatives different on different bacilli, *Blaxall*, 6140-42.

41. GLACIALINE:
- Sold in sixpenny boxes, *Cameron*, 2531.
- And boracic acid, only boric compounds known in Leeds, *Cameron*, 2537-38.
- Implicated in cases of serious illness in Dover, in association with boracic acid in milk, *Robinson*, 3301, 3327, 3345.
- Used in Broadstairs milk, *Robinson*, 3309.
- Borax and boracic acid commonly admixed in; *Halliburton*, 7544.

41a. MEAT:
- Used formerly by Newport (Mon.) pork-butchers, 4 ozs. to 40 lbs. of meat, *Jones*, 1395-98.

42. HAM:

42a. CURE:
- Generally with the sides, *Kellitt*, 70.
- Boracised at same time, but distinction between cure by, and packing in, borax not drawn, *Williams*, 2229-30, 2232, 2234-35.
- Could not be effected by dipping in boracic acid solution, *Williams*, 2233.
- By 0·6 per cent. of boracic acid, *Bell*, 2823.

42b. PICKLING:
- American, some pickled, *Kellitt*, 26.
- Nature not known, *Kellitt*, 26.
- Preservative pickling not suspected, *Kellitt*, 26-28.

42c. SALE:
- American, within a week of reaching retailer, *Kellitt*, 60.

42d. SMOKED:
- At home, as a rule, *Prossor*, 595.

43. IDIOSYNCRASY:

43a. BORACIC ACID:
- May cause toxic symptoms, *Wild*, 1463-66.
- Some people may be very susceptible, and may take large amounts in food, *Walford*, 1847-49.
- Found not to irritate witness, *Boyce*, 2752.
- Witness idiosyncratic to boracised cream, *Blyth*, 3472
- Idiosyncrasy of witness to boracised milk and food, and to boracic acid as a drug, *Tubb-Thomas*, 4930, 5014-15.

43b. PRESERVATIVES IN FOOD:
- Most children and invalids idiosyncratic, *Tubb-Thomas*, 5016.
- Matter of importance *quâ* preservatives, *Attfield*, 6569.
- Idiosyncrasy probably not of much account *quâ* preservatives, *Hutchison*, 6749-50.

44. INFANTS AND INVALIDS:

44a. Food:
Should not be chemically preserved, *Vasey*, 1992.
Ten years ago practically all such foods preservatised, not so now, *Vasey*, 1993-94.

44b. Milk, Preservatised:
Exposed to unnecessary danger thereby, *Jones*, 1309, 1362, 1365.
Not safe, *Wild*, 1429.
Possible ill effects outweighed by benefits, *Wild*, 1458.
Children on milk diet would suffer, if useful amount used, *McFadyean*, 1753.
Child might take an enormous dose of boracic acid, *McFadyean*, 1769.
Fourteen grains per quart might be harmful, especially to an infant, *Walford*, 1834.
Milk should not contain preservatives, *Vasey*, 1992, 2099, 2100; *Williams*, 2122-23; *Rideal*, 3694.
Boracised milk in children's hospital given up on account of observation in one case of infantile diarrhœa, *Handford*, 2267, 2313.
Would tax infants' digestive powers, *Annett*, 2689.
Not proper for invalids or children, *Foulerton*, 4147-48, 4152.
Should not be given to the sick, because of effect on digestibility by boracic acid, and hardening effect of formalin, even in small quantities; nor to children, *Stevenson*, 4803-6.

44c. Infants and Invalids:
Boracic acid should not be used in milk for infants and invalids, *Corfield*, 5075.
As a diet for infants and invalids, milk on a different level to other foods *quâ* preservatives, *Corfield*, 5135.
Milk of paramount importance *quâ* preservatives as being in cases an entire diet; not so butter, *Dupré*, 5906.
Conceivable that infants may suffer from preservatised milk; no evidence of such suffering in witness's possession; and Dr. Bell gives evidence to the contrary, *Attfield*, 6552-54. A question of quantity arises, 6555-56.

44d. Preservatives in Food:
Infants and invalids should not be subjected to indiscriminate use of preservatives in food, *Kaye*, 5509-12. Actual evidence of harm is not great; but there is such, and certainly presumptive evidence as to boracic acid, 5513.
Harm to infants from preservatives difficult to trace, *Hope*, 6908-9.

45. IPECACUANHA WINE:
Salicylic acid found, *Hill*, 2364; offence serious, leading to proceedings in Wolverhampton, *Hill*, 2365-67; no proceedings taken in Birmingham, *Hill*, 2425-35.

46. JAMS:
Messrs. Keiller's, except apricot, from pulps made from fresh fruit, *Boseley*, 1009.
Appearance everthing, *Boseley*, 1086.
Imported pulp cheapens jam, and must be preservatised, *Voelcker*, 1707-8.

46a. Benzoate of Soda:
Used by one London firm, *Boseley*, 968.

46b. Benzoic Acid:
Sometimes used, *Boseley*, 968.

46c. Sugar:
Best beetroot used by Messrs. Keiller, *Boseley*, 1159-60.
Most effective when boiled with the fruit, *Boseley*, 1161-65.

47. KEEPING POWER:

47a. Bacon:
With borax a month in reasonable weather, *Gregson*, 889-90; much longer if throughly cured and very dry, *Sinclair*, 935, 943.

47. KEEPING POWER—*continued.*

47b. Butter:
Trade demands a month, *Sandes*, 107; *Riley*, 849.
Nine months unnecessary, *Sandes*, 111, 112.
Best in dry butter, *Lovell*, 769.
Trade requires a week, *Lovell*, 796-800, 805.
Week longest possible (unpreservatised), *Lovell*, 804.
Weather affects, *Lovell*, 740.
Depends on preservatives, *Riley*, 850.
Imperfect make tells against, *Riley*, 851.
Cannot be determined by examination, *Riley*, 852.
Texture does not affect, *Riley*, 853-54.
Of preservatised butters not tested, *Boseley*, 1005-8.
Will go wrong without preservatives, *McFadyean*, 1762.
Trade requirements would be met by two or three months, *McFadyean*, 1788-89.
Preservatives must be used if butter intended to be kept, *McCracken*, 2858.
Pasture does not affect, *McCracken*, 2949.
Depends on use of preservatives, *DeHailes*, 4025-26.
Well made butter without preservatives keeps for six weeks, *Long*, 4642.
Keeping butter leads to decomposition in three ways, *Richmond*, 5716-18; dry butters tend to keep better than moist, 5719-24, but the action of water can be counteracted by salt, 5725. Trade purposes of Aylesbury Dairy Company served by ability of butter to keep one week, 5728. Action of preservatives on butter chiefly chemical or chemico-biological, 5755-58.
Preservatives needed because butter required to keep. If used fresh, need for preservatives would be less, *Lough*, 6626. Keeping power of butter greater when both pasteurised and preservatised, 6682. Salt must be used if butter be kept some time, 6685-86.

47c. Butter: Australasian:
Should be made to keep a month out of cold store, *Trengrouse*, 663-73.
Keeps sweet three weeks out of cold chambers certainly in winter, *Riley*, 846-48.
Equally well for 6 weeks with or without preservatives, *Voelcker*, 1682, 1723-29.

47d. Butter: Borax and boracic acid:
One per cent. kept butter nine months, *Sandes*, 107-10.
Three-quarters per cent. keeps butter for three or four months, *Dale*, 250, 282, 290-91.
One-half per cent. keeps butter three or four days, *Lovell*, 725, 783, 793.
Will only keep butter a month at most, *Lovell*, 803-4.
On wrappers will not keep butter, *Lovell*, 807-8.

47e. Butter: Brittany:
Needs rapid, day by day, consumption, if not preservatised, *Trengrouse*, 632-36.

47f. Butter: Canadian:
Preservatised, has been kept three months, *Hudson*, 549-50.
Refrigerated, inferior to Colonial preservatised, *Clement*, 1508-10.

47g. Butter: Danish:
Better than English, *Kellitt*, 45-47.
Consumed more quickly than Irish butter, *Dale*, 249, 301-2; *Shanahan*, 401-3.
Deteriorates if kept long, *Dale*, 300.
Travels far in competition with local produce, *Dale*, 313-15.
Better than Irish, *Shanahan*, 364-66.
Inferior to Irish heavily salted butter, *Shanahan*, 399-400.
Inferior to Colonial, Normandy, or Irish, *Hudson*, 502-4; *Lovell*, 718.
Difficulty in keeping it, *Trengrouse*, 631, 654.
Keeps longer than Brittany, *Trengrouse*, 694-96.
Good as any, *Riley*, 819.
Keeps with or without salt, *Riley*, 833.

47. KEEPING POWER—*continued.*

47g. Butter, Danish—*continued.*
„ : Lost, *Clement*, 1516-17.
Butter for quick consumption, *Dunn*, 3035.
Does not keep long, *De Hailes*, 4019-22.
Keeping quality of Danish butter keeps it for a minimum of some three weeks, *Faber*, 4223, 4227, in summer and much longer in winter, 4318-22, for some seven weeks, and then it is sold as fine fresh butter, 4323-26, at top price, 4327-31. Price hangs on many factors, 4332. Results of experiments as to keeping quality promised, 4339 (App. No. 26). The butter not improved by preservatives, 4225, if butter well made, 4226. Nearly exclusively made of pasteurised milk, 4227, by reason of an Act aimed at checking the spread of tuberculosis in cattle, 4228. Keeping quality as good as ever, 4276. Some butter will be three weeks old on reaching retailer, 4278-79, being salted butter; saltless butter consumed more quickly, and only some two per cent. of whole export trade, 4280. One per cent. of salt will keep butter three weeks, 4281. The more water the poorer the keeping power of butter, 4282. Some 14 per cent. of water in Danish butter on shipment, 4283, some of which evaporates in transhipment, 4284. Probably more in Irish butter, 4285-89, though no necessity for it, 4290, and probably little difference in well-made Irish butter, 4291-95. Normandy factory butter drier than Danish, 4301. Its flavour varies, 4302, and the finest goes to Paris, 4303.

47h. Butter: Irish:
Will keep for a long time, *Dale*, 273, 277; would be affected by prohibition of preservatives, 248.
Poor, demanding a preservative, *Shanahan*, 441-49.
Varies on adjoining farms, *Shanahan*, 365-66.
Preservatised butter known to keep well, *Shanahan*, 398.
Heavily salted, better than Danish, *Shanahan*, 399-403.
Never kept beyond a fortnight, *Shanahan*, 460-64.
Some mild-salted, unpreservatised, will keep for three weeks, *Shanahan*, 469-73, 477-78.
Not affected by period of lactation of cow, *Shanahan*, 479-82.
Affected by moisture of butter, *Lovell*, 768-69.
Not aware of failure of Danish instructors to produce Irish butter of Danish keeping quality, *Voelcker*, 1735-36, 1738.
May be affected by uncleanliness, *McFadyean*, 1762-63.
Not very good, *McCracken*, 2938-43.
Keeps well, *Dunn*, 3024.
Dry salted butter and warm pickle butter keep equally well, *Dunn*, 3025-26.
Depends on expulsion of buttermilk and water, *Dunn*, 3029.
Mountainous country butter commonly believed to keep best, *Dunn*, 3029.
Not affected by amount of water present, *Dunn*, 3032-33.
Salted butter used to be stored for months, *Dunn*, 3036.
Neither pasture nor manufacture held to render it inferior to Danish, *Long*, 4644.
Keeping power of Irish saltless butter under one week, without preservative, but a fortnight at any rate with preservative, *Gibson*, 6314. Salt preservatised butter keeps for four months, 6315-16, 6376. Irish butter essentially a keeping butter; not so Danish and Normandy, 6317.
Butter experimented on, kept nine months with preservative added, *Gibson*, 6364. Irish butter keeps much longer than Danish, 6393.

47j. Butter: Normandy:
Requires rapid consumption, *Trengrouse*, 632.
Goes into consumption at once, *Lovell*, 725, 793-95, 801-2.
Better than Danish now, *Lovell*, 726.

47. KEEPING POWER—*continued.*

47k. Butter: Preservatives:
Keeps a month, *Sandes*, 87.
Boracised better than heavily salted butter, *Sandes*, 107-10.
Butter will keep till needed, *Shanahan*, 390-94.
Regulates price, *Shanahan*, 395–97.

47l. Dairy Products: Formalin:
Milk unchanged for months with $\frac{1}{2000}$, *Boseley*, 992, 995-97, 1002.
In $\frac{1}{50000}$ not always effective for 48 hours, nor for 24 hours in $\frac{1}{25000}$, but $\frac{1}{12500}$ keeps milk for 48 hours, *Annett*, 2642-44.
Milk can be kept sweet by $\frac{1}{50000}$, *Foulerton*, 4048-49, 4080, 4088-91.
Mr. Thomson held that $\frac{1}{8000}$ formic aldehyde kept milk sweet for a week at room temperature, *Foulerton*, 4086-87.

47m. Margarine:
Not known to be inferior to butter, *McCracken*, 2858.
Bettered by preservatives, enabling margarine to keep as long as salt butter, *McCracken*, 2882, 2884, 2992-93.
Contained milk makes it "go off," *McCracken* 2885-90.

47n. Milk:
Ten to 12 hours old when distributed, *Boseley*, 1022, 1024-25.
Should keep 24 to 36 hours, thus requiring a preservative, *De Hailes*, 3914-15.
Affected by surroundings, *Voelcker*, 1739.
Affected by health of cow, *Voelcker*, 1740-42.
In large quantities, not known, *Annett*, 2645-46.
Milk difficult of manipulation without boracic acid, even when pasteurised, *Bell*, 2839-44.
Cooling will aid, but not long in hot weather, *McCracken*, 2872.
Skim milk changes just as quickly as new milk, *McCracken*, 2906.
Refrigeration assists, *McCracken*, 2923.
Depends on conditions of storage, *Brierley*, 3176.
Preservatised milk goes bad rather than sour, *Brierley*, 3178, 3254-55.
Should keep 60 hours; but a time limit of 24 hours preferable, *Brierley*, 3256-58.
Can be kept for 24 hours even in warm weather by formaldehyde, $\frac{1}{50000}$, or a mixture of borax and boracic acid, $\frac{1}{2000}$, or if added at time of milking, $\frac{1}{75000}$ of formaldehyde would suffice, *Rideal*, 3681, 3697.
Preservatised milk can be kept sweet overnight, *Rideal*, 3762-71.
Will not keep for 24 hours in extreme heat even if cooled, *Foulerton*, 4115-19, 4134-35.
Keeping quality of milk affected by temperature, *Carrington Smith*, 4427, but greatly dependent on cooling, straining, and cleanliness, 4504-15.
Depends on many phases of cleanliness, *Long*, 4588.
Properly treated milk will keep 48 hours under all circumstances, *Tubb-Thomas*, 5041-44.
Keeping quality of preservatised milk matter of experiment, *Richmond*, 5714-15 (App. No. 31). Trade purposes of Aylesbury Dairy Company served by ability of milk to keep 18 hours, 5729, and should be so for all trade purposes, 5730-31. No need for preservatives to secure this, 5732. At 70° Fahr. milk keeps sweet for 34 hours, for 22 hours at 80° Fahr., for 15 hours at 90° Fahr. bottled, in a chamber, 5732-33. Highest temperature of milk on first reaching Aylesbury Dairy Company's premises, 77° Fahr.; highest on coming back from a round, 83° Fahr., 5733. Some few complaints of sour milk, 5734-35.
Milk rarely required to keep more than six hours after delivery to houses, *Hattersley*, 5879, or customer would scald it, 5880. Treatment in house important *quâ* keeping power of milk, 5881, 5899.
(*See also* under Experiments, Formaldehyde.)

47. KEEPING POWER—*continued.*

47n. MILK—*continued.*
Storage of unpreservatised milk in the houses of the poor may lead to its going bad before consumption, *Hutchison*, 6761, 6763-66. Exceedingly difficult to get poorer class to properly house milk, 6762.
Milk should contain no preservatives if it can be guaranteed against going bad in consumers' hands without them. Some delivered to Great Ormond Street Hospital goes bad in summer by the time it reaches the children, *Still*, 6789, 6813.
Milk kept sweet for some time by a limited application of cold, *Hope*, 6828.

47o. MILK: Boracised:
As ordinarily used, for a limited period only, *Mann*, 2605, 2612.
For 48 hours with 35 grains per gallon, *Annett*, 2647.
Milk can be kept sweet by $\frac{1}{2000}$ boracic acid, *Foulerton*, 4048-49, 4080.
Mr. Thomson held that $\frac{1}{2000}$ boracic acid kept milk sweet for a week at room temperature, *Foulerton*, 4086-87.
Milk that kept good with borax added, went bad with a similar quantity of boracic acid, *Halliburton*, 7546-47.

47p. MILK: Preservatised:
Dr. Rideal's experiments show not the slightest effect accruing from the use of preservatives in milk in 24 hours, *Foulerton*, 4185-86.

48. LARD:
Requires no preservative, if well made keeps a long time, *Bennett*, 206.

49. MANUFACTURE:

49a. BORAX:
Factory workers enjoy phenomenal health, *De Hailes*, 4036-41.

49b. BUTTER: Australasian:
Passes from creamery to factory, *Trengrouse*, 662.
Plenty quite as fresh as Danish, *Trengrouse*, 689.
Still room for improvement in New Zealand butter, *Cameron*, 6303, and measures are taken accordingly, 6304. Butter made at dairy factories and graded by Government inspectors, 6159-60. "Factory" butter as known at home is "milled" butter of second grade in New Zealand, 6161-62. Best butter exported with salt and in many cases Preservitas, 6163-64, principally boracic acid, 6165. A little has been sent absolutely fresh, but bulk with salt, 6166, and a good deal is preservatised, 6167. Milk sent to dairy factories distance of some four miles twice a day, 6185.
Salt added to New Zealand butter to suit taste of consumer, *Cameron*, 6170.
Cooling of milk compulsory in New Zealand, but not enforced according to Mr. Sorensen, *Cameron*, 6290-93.

49c. BUTTER: Danish:
Improved methods have led to large export to England, *Dale*, 261-62.
All-year-round trade, *Shanahan*, 415; *Davidson*, 1624-26.
On scientific basis and in bulk, hence successful competition with Ireland, *Lovell*, 750-51.
Cows housed eight months a year, and food plentiful, *Davidson*, 1630.
Tub butter, *Bannister*, 3513-14.
Tuberculosis has nothing to do with dairying system, *Long*, 4670-71.
Inspection made of farms, *Long*, 4665-67.
Cattle housed in Denmark eight or nine months a year, *Lough*, 6654-56, in Ireland from four to six months, 6657.

49d. BUTTER: Irish:
Danish methods adopted under instructors, *Sandes*, 115-16.

49. MANUFACTURE—*continued.*

49d. BUTTER: Irish—*continued.*
Danish methods would handicap producer, especially in hot weather, *Dale*, 298-99; *Lovell*, 766.
Improved by factory and creamery systems and boracic acid, *Shanahan*, 387-89.
Little made in winter, *Shanahan*, 416-19.
Ireland has nothing to learn from the Danes *Shanahan*, 487.
Old methods still in use, *Lovell*, 747.
Small quantities made, *Lovell*, 750.
Education of Irish butter makers at fault; Danes well educated, *Gibson*, 6357-60. Improved education needed, 6397.

50. MARGARINE:
Salt added. Absolutely fresh, not known to be consumed, *McCracken*, 2883.
Not dealt in by Aylesbury Dairy Co., *Hattersley*, 5806.
Not exported from New Zealand, *Cameron*, 6226, nor made there, 6227.
Made in Ireland, *Gibson*, 6371-72.

50a. SOLD AS BUTTER:
Often, *Hill*, 2351.
Boracised samples, mostly, *W. C. Williams*, 5173-74.

51. MEAT EXTRACTS:
Generally free from preservatives, outside salt, *Fisher*, 4717.

52. MEATS, TINNED AND POTTED:
Slightly salted, *Trengrouse*, 642.
Crosse and Blackwell use no preservatives, *Blackwell*, 4868-70.
Generally free from preservatives, outside salt, *Fisher*, 4717.

53. MEDICINAL USE:

53a. BORACIC ACID:
Prescribed moderately, *Handford*, 2289.
Intermittent dosage recommended because of discomfort following maintained use, *Handford*, 2290-91.
Given in epilepsy; appetite failed, *Handford*, 2295.
Given to infants for thrush, *Cameron*, 2534, up to 20 grains a day without seeming harm, *Blyth*, 3464-66.
Medical men and patients handicapped by unconsciously obtained immunity, *Boyce*, 2737-38.
Studied, *Bell*, 2783-84.
Putridity of urine treated, *Bond*, 3085-86.
Good for thrush, *Brierley*, 3245.
Injury held to have followed, *Robinson*, 3304.
Fallen into disuse; got elsewhere now than in prescriptions, *Corfield*, 5091-92. Some medical men still use it and believe in it, as a drug, *Corfield*, 5138-44.
Harmfulness vouched for on much evidence, *Starling*, 6944.
Internal application of boracic acid not known, *Starling*, 6978.
For treatment of infantile diarrhœa would be bad, *Anderson*, 7213-15.

Boracic acid used medicinally in large quantities has, according to Dr. Church, caused digestive disturbance; not so in small quantity, *Womack*, 7492. Harmful doses were of 15 grains, 7494-96, every four or six hours, 7497. Not aware of 80 grains in a pint of milk, 7498, which would modify Dr. Church's opinion, 7499.

53b. SALICYLIC ACID:
For indigestion, not known, *Bond*, 3143.

54. MILK:

54a. ADULTERATION:
Preservatised samples most frequently adulterated, *Hill*, 2397-98, and poor most likely to get such milk, *Kaye*, 5458, 5490.
Watered milk does not stand specialy in need of preservatives, *Hill*, 2399, 2400.
More in poor districts, *Cassal*, 3809-12.

54. MILK—*continued.*

54a. ADULTERATION—*continued.*
Boracised milk held by witness to be "adulterated," not so held by Local Government Board, *Cassal*, 3816, 3865.

54b. BACTERIAL ACTION:
Bacterial growth rapid, *Boyce*, 2749.
Bacillus coli and enteritidis sporogenes present numerously in sweet milk, *Boyce*, 2750.
Germs of disease killed by pasteurisation, *Bell*, 2842-43.
Bacteria should be kept from milk rather than inhibited when there, *Tubb-Thomas*, 5026.

54c. CONDENSED:
"Preserved" milk now held to mean condensed milk, *Foulerton*, 4151.
Injurious for children, *Foulerton*, 4152.
Use of tinned milk increasing, *Kaye*, 5528-30, and used all the year round, 5533-34, but general absence of preservatives therefrom not known, though not held improbable, 5531-32.

54d. CONSUMPTION:
Would not be recommended by medical men in large quantities unless guaranteed as free from boracic acid, with mischievous result from such restricted milk diet, *Handford*, 2320-21.
Should be consumed within 48 hours of milking, *Tubb-Thomas*, 4949.
In Midland and Southern counties some 85 per cent. of milk consumed by children and invalids, *Tubb-Thomas*, 5021-23.
Suckling declining in West Riding, *Kaye*, 5527.

54e. DELIVERY:
Only one delivery of milk daily at Copenhagen, *Sorensen*, 7034, with advantages affecting consumer, 7035. Cleanliness and prompt cooling of milk enable one delivery to suffice, 7036. One delivery daily would compensate for cost of refrigeration, 7044, and cheapen milk, 7045, with tendency to concentration of vending, 7046, but not of dairying, 7047. Equality of milk standard would also result, 7051-52. One delivery daily suffices for Manchester; hence also probably would for London, 7053. It is now welcomed in Manchester, 7059. Ice is requsite, 7132, but not for delivery twice daily, 7133-35.

54f. HOSPITAL:
Hospitals get milk from good companies, *Hutchison*, 6774, and some have analyses made from time to time, 6775. Details of milk contracts not known to hospital medical staff, 6776-79. There can be no objection to contracts, 6780, and reasonable to exclude preservatives in the contracts, 6781.
Desirable that hospital milk should be examined for preservatives, *Still*, 6811. It could be done by arrangement outside, 6812. No preservative found in milk specimens examined from Great Ormond Street Hospital, 6814.
Milk at Liverpool Hospital very frequently analysed, *Hope*, 6884, for preservatives, including nature and amount, 6885-87, 6889-90. Milk should contain no preservatives, 6888, 6891, especially in fever hospitals, as digestive processes are thereby interfered with, 6892.
Milk of Nottingham General Hospital tested for preservatives, *Anderson*, 7193-96.
Milk supply to all hospitals should be examined for preservatives, *Brunton*, 7465.

54g. PURE:
More important than unstinted supply, *Walford*, 1912-13.
Should be pure and satisfactory, or its sale relinquished, *Cassal*, 3806.

4h. SEPARATED:
Separators introduced in some parts of Devonshire, *Long*, 4594.

54. MILK—*continued.*

54h. SEPARATED—*continued.*
Separated milk dealt in by the Manchester Pure Milk Supply Co., *Sorensen*, 7080-81, demand being some six per cent. of whole milk demand, 7082. Desirable to stop the fraud of selling separated milk as whole milk or admixed with whole milk, 7084-7113. Customers of Manchester Pure Milk Supply Co. dealt with directly, 8157.

54j. STALE:
May be sold by reason of contained boracic acid, to prejudice of customer, *Stevenson*, 4826-28.
Sold by aid of preservatives, *Kaye*, 5498-5501.

54k. STORAGE:
Often kept in filthy circumstances in poor-district houses, and on vendors' premises, *Foulerton*, 4120-22, 4128, 4170-73.

54l. SUPPLY:
Newport (Mon.), local, *Jones*, 1399.
Better to populous places than formerly, *Walford*, 1911.
To Cardiff from home counties, some 8 hours old on reaching consumer, *Walford*, 1919-20.
To rich and poor not on same footing as to guarantee of freedom from preservatives, *Handford*, 2310.
Stringent clause as to preservatives in Leeds Fever Hospital milk contract; no boracic acid found in it; precautions at children's hospital not known, *Cameron*, 2540-44.
To Dunragit creameries some 10,000 to 15,000 gallons daily, *McCracken*, 2875.
Of skim-milk to cities as separated milk in winter, *McCracken*, 2909.
Sent out daily from Dunragit creameries; some may be 24 to 28 hours old on despatch, *McCracken*, 2933-36.
Institutions should be watched, and milk analysed for preservatives, and notes taken as to health of children supplied with the milk, *Brierley*, 3252.
Delivery more frequent prior to use of preservatives, *Brierley*, 3262-63.
No greater difficulty than formerly in getting milk in enlarged Southampton, *Brierley*, 3265-67.
Milk made into butter prior to use of preservatives, now comes to town as milk, *Brierley*, 3278.
Small vendors tend to be crushed out by organised trade, *De Hailes*, 3946-48.
Interests of small vendor not superior to those of the general public, who would not suffer if he disappeared, if milk supply could be otherwise kept up, *Foulerton*, 4062-64.
Large trade in hands of small vendors, *Foulerton*, 4129-30.
Calving is regulated on a fixed basis for Manchester Pure Milk Supply Co., *Sorensen*, 7072-75.

55. MOISTURE:

55a. BUTTER:
In delicate butters calls for preservatives, *Trengrouse*, 652.
Determines price and keeping quality, *Trengrouse*, 700-1.

55b. BUTTER: Danish:
Drier than Irish, *Clement*, 1512.

56. NECESSITY FOR PRESERVATIVES:

56a. BORAX AND BORACIC ACID: Butter:
Used only on this account, *Lovell*, 749.
To Irish butter trade, *Lovell*, 737, 747; to all butter, especially Australian, *Clement*, 1503-5.

56b. PRESERVATIVES:
Not necessary in food generally, and misleading to the public, *Hehner*, 5593, 5634-35.

56c. PRESERVATIVES: Bacon:
Essential to mill hands, *Davidson*, 1588.

56d. PRESERVATIVES: Butter:
Advised as indispensable, *Kellitt*, 122.
To Irish trade, *Shanahan*, 363, 441

56. NECESSITY FOR PRESERVATIVES—*contd.*

56d. PRESERVATIVES—*continued.*

To cold stored butter, *Hudson*, 555.
Unnecessary, *Jones*, 1361.
Not in butter properly made under proper conditions, *Voelcker*, 1734; *Brierley*, 3189-90.
Trade to-day demands a preservative, as regards factory and creamery butter, *Bannister*, 3502-5, 3532, 3536-37.
Not for butter quickly reaching consumer, *Hehner*, 5594-95.
Butter preservatised by Aylesbury Dairy Company years ago, *Richmond*, 5673; but not now, 5674, 5679. Butter was either washed with a solution or had the acid worked in, 5675. By washing, some of the acid was retained in the butter, 5676; boracic acid itself being used, 5677: and ½ per cent. added, 5678. Done away with because objected to by the public, 5680-81; and as matter of policy, 5682. No consequential trouble, 5683. Butters imported from France are preservatised, 5684. Percentages of boric anhydride contained handed in, 5685-86. Still sell such butters, 5687. Boric compounds not absolutely necessary in such butters, but trouble may be caused by non-use, 5688. Salt equally efficacious, 5689. Danish butters found free from preservatives, 5691.

56e. PRESERVATIVES: Food:

At certain seasons, *Vasey*, 2003.
Chemicals unnecessary in food, and objectionable, *Cassal*, 3816.
All unnecessary, *Tubb-Thomas*, 4977.

56f. PRESERVATIVES: Milk:

Unnecessary for trade purposes, *Jones*, 1309.
Ideal milk should not contain them, *Wild*, 1493.
Not necessary, undesirable, and as a rule physiologically indefensible, *McFadyean*, 1752.
Not requisite, *Williams*, 2170, 2177-79, 2257-58; *Brierley*, 3256; *Long*, 4570-74.
Only in winter, *McCracken*, 2878-79.
Large town trade demands them as now organised, *Blyth*, 3447-48, 3476-81.
Trade requirement counter-balanced by such amounts as 80 grains of boracic acid per pint, *Bannister*, 3641.
Great difficulty in large town trade in summer, apart from a preservative, *Bannister*, 3642-44.
If only 9 per cent. of Birmingham milk preservatised, no great necessity therefor, *Bannister*, 3645-47.
No necessity for milk kept 39 hours at 55½° Fahr., nor for milk kept 23 hours at 64° Fahr.; and preservative shows little preservative effect on milk, even at the temperature of a summer's day; but just sufficient retardation of acidity of milk to justify the use of preservative, *Rideal*, 3701-61.
None for London, *Cassal*, 3803-4.
Necessary, and present trade demands them, *De Hailes*, 3928-29, 4003, 4016-19.
Required to a certain extent, *Foulerton*, 4047.
Large vendors can do without them, *Foulerton*, 4060.
Distance an important factor, *Foulerton*, 4061, 4128.
Would cease if milk properly stored, *Foulerton*, 4126-27, 4171-72.
Birmingham evidence as to 91 per cent. of her milk supply unpreservatised, an element against necessity for preservatives, *Foulerton*, 4131-33.
None used by witness in sending milk to London from Mid-Staffordshire, *Carrington Smith*, 4414-15. No complaint of milk lost save as to Sunday milk sometimes, 4416-18, 4515. All, save Sunday milk, in consignees hands in 12 hours, 4419-24. During four winter months milk sent out only once a day, 4425-27. His milk goes to Birmingham now for reasons of price, 4550-52. Milk from Aylesbury Valley sent to London without preservative, 4428-30; but milk cooled, 4431. Also from Faringdon, Berkshire, in large amount, 4440-41, 4539; and from a point equi-distant with Staffordshire, from 1,500 cows, 4443-46. Cooling and straining of milk render preservatives unnecessary, 4515; in any part of England, 4549.

56. NECESSITY FOR PRESERVATIVES—*contd.*

56f. PRESERVATIVES: Milk—*continued.*

Not necessary in rural districts, and none used as a rule; not necessary in Oxfordshire, *Fisher*, 4717, 4749-51.
Not necessary if milk properly cooled, and due regard paid to cleanliness, *Stevenson*, 4801.
Large vendors use precautions, which render preservatives unnecessary, *Stevenson*, 4802.
Not necessary, even in large towns, *Tubb-Thomas*, 4934-35.
Not necessary for Liverpool, *W. C. Williams*, 5289, 5305.
Vendors declare them to be necessary, *Kaye*, 5447.
Unnecessary, *Kaye*, 5448-50, 5519.
No necessity; milk of a large London dairy company free from all preservatives, *Hehner*, 5580-81, 5607.
Milk supplied to Aylesbury Dairy Company from distances up to 200 miles, *Hattersley*, 5768-70, 5846; even in summer, 5847; and free from preservatives, 5771-72; as being unnecessary, 5773-76; and from a protectionist policy many years ago perhaps, 5776. Stipulations as to non-use of preservatives with contracting farmers, 5776, 5882-83. Only 78 letters of complaints as to sour milk out of upwards of five million deliveries, 5776-77, 5875; and these chiefly owing to improper treatment of milk by customer, 5832.
Preservatives seldom found in Liverpool milk samples, *Hope*, 6828. No necessity for chemical preservatives in milk, 6829, 6837, 6839; even in large towns, 6896. Vendors say public want them, 6838. This is not so, 6839, 6864. Liverpool milk supply comes from a radius of some 50 miles, 6831-33.
Milk of Copenhagen Milk Supply Company not preservatised, *Sorensen*, 7022. No preservatives used in milk supplies of towns in Denmark. They are strictly prohibited by law, 7023. They may be used in small villages, 7024; where the law is not so strictly enforced, 7024-27. Dr. Stein known by witness years ago, 7028. He is official analyst to Danish Government, 7029; and his functions extend all over the kingdom, 7030-31. Quite possible to supply large towns with unpreservatised milk, 7032, 7043. Manchester Pure Milk Supply Company use no preservatives, 7033. They get milk from nine farms, 7048-49. Have existed for one year, 7050. Trade increasing, 7130-31. Customers of mixed, but chiefly of middle class, 7151-53. Sanitary conditions of lower classes in English towns perhaps not so favourable to keeping milk as in Copenhagen, 7154-56.
Experiments made demonstrate preservatives to be unnecessary in refrigerated milk, *Schidrowitz*, 7223, 7230-31. Experiments described, 7224-29.
Milk can be supplied to large towns unpreservatised, *Brunton*, 7428, and should be, 7429.

57. NITRATE OF POTASH:

Need not be condemned; rarely met with, *Hehner*, 5636.
Should be prohibited as a preservative, *Halliburton*, 7576.

58. ORDERS AS TO DAIRIES, COWSHEDS, &c.:

Need enforcement, *Handford*, 2323-24; *Corfield*, 5114.
Indifferently enforced, *Kaye*, 5452. Preservatives abet evasion of regulations, 5453-54. Insanitary conditions affect milk, 5479-80.

59. OSMIC ACID:

Vapour an irritant, *Boyce* 2756.

60 PASTEURISATION:

Destroys fine flavour of butter, *Lovell*, 727.
Destroys keeping qualities of frozen butter, *Lovell*, 727.
Given up by Colonies and Argentine, *Lovell*, 728.
Fad of the Danes, *Lovell*, 730-31.
Expensive, *Lovell*, 730-31.
Destroys flavour of cream, *Lovell*, 732-33.
Not practised, *Boseley*, 1026-27.
Practicable in Manchester, *Wild*, 1437-39.
Does not obviate need for boracic acid in milk, *Bell*, 2839-42.
Experimentally only at Dunragit creameries; flavours milk objectionably, *McCracken*, 2895-2901.
Milk raised to 160° to 170° F., *McCracken*, 2902.
Cost not known, *McCracken*, 2903-5.
All skim-milk sent from Dunragit creameries, pasteurised, *McCracken*, 2903-5.
Not used for preservatised milk, *Brierley*, 3181.
Possibly a question of organisation; would doubtless increase price, *Blyth*, 3449-51.
If in force in Copenhagen, that a small place compared with London, *Blyth*, 3452-53.
Pasteurisation and sterilisation change the character of milk, *De Hailes*, 3964-66, 3972-75, and the change may have grave effects on children and invalids, 3976. Continental general use of cooked milk not known, 3982-84.
Pasteurisation of all milk effected by one large dealer, *Long*, 4585-88.
Pasteurisation used by some Wiltshire and other dairies, *Tubb-Thomas*, 4980, 4983-84, 4986. Trade springing up, 4982. Milk is bottled, 4985, at same price at Leicester, 4987. Exact temperature not known, 4988.
Pasteurised milk has little demand, *Hattersley*, 5783-84; milk heated to 160° F., 5785.
Pasteurisation more needed in winter in North than in South Ireland, because of the winter stall feeding of cattle, *Lough*, 6627. Denmark needs pasteurisation for same reason, 6627-28, and to erase feed taint, but butter from field-drawn milk needs no pasteurising, 6629-30. Pasteurisation held to be most valuable, 6631-32. Temperature in pasteurising some 175° to 185° F., 6633. Improvement of milk of house-fed cattle by ferments or cultures not known, 6634-36. Practical difficulties in dealing with large quantities of milk are being overcome, 6690.
Milk ideally should be sterilised or pasteurised and unpreservatised, *Hutchison*, 6723, 6760. Sterilised milk has advantages for children, 6724-25. Pasteurisation would be of great good as a germicide, 6726.
Sterilisation or pasteurisation and even boiling of milk held to be harmful to children, *Still*, 6791, 6799, especially the former, 6800. Infantile scurvy or mal-nutrition follows prolonged heating of milk to a high temperature, 6792-93. Reason not known, fact remains, 6794, and is well recognised, 6795. The scurvy can be produced by almost any patent food, 6796. The disease increasing, 6797, and is due to such milk and foods, 6798. Freezing of milk might have like effect, 6801, moderate cooling would not, 6802.
Pasteurising of milk in Denmark and Copenhagen not universal, *Sorensen*, 7171-74. Manchester Company opposed to the practice, 7175, 7183, as unnatural and injurious, 7176, on medical advice, 7177, as rendering milk indigestible, 7178. It caramelises the milk sugar and coagulates the albumen, 7179, and flavours the milk, 7180-82.
Sterilised milk cannot be regarded as the same thing as fresh milk, *Poore*, 7366. What happens to pasteurised milk kept under modern low-class filthy town conditions is matter of serious conjecture, 7419.
Pasteurisation of milk likely to alter and render less digestible the proteids in milk, *Halliburton*, 7601-14, but any specific toxic action brought about by boiling of milk must be very slight, and if existing should have been discovered long ago, 7614-21. No poisoning effect to be feared from re-arrangement of inorganic phosphates in milk, 7622-23.

60. PASTEURISATION—*continued*.

60a. BUTTER: Australasian:
Pasteurisation in New Zealand used to slight extent, *Cameron*, 6179, with rather unfavourable result, 6198, 6200, by removing the finer taints, 6199, necessitating a ferment, 6200. Quality of pasteurised butter not quite so good as ordinary butter, 6201, 6294-6300, and quality goes off after defrosting, 6202. With perfect milk pasteurisation not needed, 6301-2. Pasteurisation brings up the average of butter, 6305-7.

60b. BUTTER: Canadian:
Practised, *Riley*, 820.

60c. BUTTER: Danish:
Largely effected, *Lovell*, 727; *Dunn*, 3017.
Accounts for good keeping quality, *Riley*, 819.
To be commended, *Riley*, 823, 840.
Improves butter, *Riley*, 824-26, 841.
Employed for some years, *Riley*, 842.
Has lessened keeping quality, *Clement*, 1517; *Davidson*, 1596, 1614.
Pasteurised, and hence acquires a distinct taste, *De Hailes*, 4023.
Sterlisation of milk by two large firms in Copenhagen, *Faber*, 4216, 4258, by pasteurisation; and cream also treated thus, 4217, in 97 per cent. of dairies, 4231, even before requirement that cream be pasteurised, 4309, and milk heated to 185° Fahr., 4218. Pasteurisation does not interfere with flavour of butter, 4228, but colour test can distinguish pasteurised butter, 4229; not so the palate, 4230. It helps fermentation, 4231. Does not flavour milk unless the milk be heated to over 85° C., and need not flavour it, 4248-49; a matter of rapid cooling, 4250, even with 90° C., 4251-53. Raw milk avoided in Denmark; many people boil any unpasteurised milk purchased, 4254-55. Vending of pasteurised milk not the rule, 4256-57. One town demands that milk be pasteurised or drawn from cows which have stood tuberculin test, 4258. All towns have power so to rule, 4260-62. Necessity for pasteurising milk only related to prevention of cattle disease by tuberculosis, 4227-28, 4259. Pasteurised butter adjudged the best, 4309-11. Pasteurisation medically recommended, 4334-36. Milk very often boiled on Continent, 4337-38. Perhaps 25 per cent. of Copenhagen milk supply pasteurised, 4340-43, and milk brought from distances of 120 miles, 4345-46. Infantile mortality of town not known, 4344. Milk cooled prior to train journey, 4347-48. Cost relatively to large trade small, 4349. Small farms cool with water, and factories or dairies with ice, 4350-52. Committee would be welcome to see Copenhagen method of treatment; that of Pasteur Milk Supply commended, 4353. Reference to bouquet of cream as produced by fermentative agents promised, 4357-59.
Danish butter is from milk practically sterilised, and then re-inoculated by flavour germs, tending to keep it sweet, *Long*, 4667.

60d. BUTTER: Irish:
Cork creamery uses, *Dunn*, 3017.
Factory butter could not be pasteurised, *Dunn*, 3017.

(*See also* Sterilisation.)

61. PEAS:

61a. CONSUMPTION:
May be two or three years old, *Copeman*, 1234.
No one would eat more than ½ lb. of preserved peas, *Copeman*, 1275-76.
Dry marrowfat peas largely used for soup, &c., *Copeman*, 1277-79.
In 5 ozs. of peas more than one grain of copper, *Copeman*, 1301.

61. PEAS—*continued.*
61b. DETERIORATION :
Takes place after two or three years, *Copeman*, 1235.
Thick and cloudy in 7 or 8 years, *Copeman*, 1293-94.
61c. DIGESTION :
Peas would naturally remain in alimentary canal some 24 hours, during which digestion and absorption of copper would go on, *Cameron*, 2561-62.
61d. PRESERVATION:
For three months would be useless for trade purposes, *Copeman*, 1236-37.
No change in greening of peas in last 18 years, *Copeman*, 1246-47.
Different treatment in France as regards copper of peas for home use and for exportation, *Copeman*, 1249-52.
61e. UNCOLOURED :
Used brown in Germany generally, *Copeman*, 1232.
Used stewed *au naturel* in parts of France, *Copeman*, 1232.

62. PENETRATIVE POWER :
62a. BORACIC ACID :
Some, *Prossor*, 592-93.
Nil, as to bacon, *Gregson*, 898-99.
Would permeate hung hams, *Davidson*, 1588-89.
Hams penetrated would not be sold as fine meat, *Davidson*, 1588-89.
Should not be used for hung meats, *Davidson*, 1615-19.
Has been known to penetrate an inch into moist meat, *Davidson*, 1590, 1592, 1611-12.
Penetration of meat tested by smell, *Davidson*, 1604-8.
Found pervading whole ham, *Hill*, 2356-57.
Hams found to be cured with borax, with from 4 to 24 grains per lb. in the meat, *W. C. Williams*, 5176-77, the meat having been penetrated, 5178, some of the meat being foreign, 5179; and bacon found to be penetrated by borates, 5180.
If it does not get into the meat no harm done, *Harris*, 5962. No experience of the practice, 5964, nor of the trade, 5966.
Penetration of meat by sprinkled borax demonstrated by experiments, *Harris*, 5968-78, 6019-27.
(*See also* under Bacon, Danish.)
62b. BORACIC ACID : Game :
Does not penetrate, *Hudson*, 520.
62c. BORACIC ACID : Meat:
Does not penetrate, *Hudson*, 520.
62d. BORAX : Bacon :
Slight, if any, *Kellitt*, 17, 18, 36-38.
Does not penetrate, *Bennett*, 140, 148.
Penetration possible if large amount used for long contact with meat, *Bennett*, 152-55.

63. PEPPER :
Not foreign to the animal body, *McFadyean*, 1800.

64. PERCENTAGES OF FOODS PRESERVATISED :
64a. BUTTER :
In 44·5 per cent. of samples examined in Cardiff, *Walford*, 1841.
Some 26½ per cent. of samples examined in 1899, in County Glamorgan, *Williams*, 2126.
In 28 per cent. of samples examined in Birmingham in 1896-99, but varying seasonally and locally, *Hill*, 2344-48, 2385, 2472-74.
Dr. Dyer found 30 of 234 butter samples boracised, *Fisher*, 4717-21.
Probably three-fourths of imported butter preservatised, *Hehner*, 5616-19, 5631-33.
Ninety per cent. of numerous samples, *Hehner*, 5564-65.

64. PERCENTAGES OF FOODS PRESERVATISED—*continued.*
64b. MILK, BORACISED :
Some 8 to 13 of total samples in Cardiff, *Walford*, 1829-30.
In 1896 in Birmingham, 8·3 per cent. of samples, *Hill*, 2334.
Dr. Dyer found only one of 270 samples boracised, *Fisher*, 4717.
In skim milk and separated milk borates found more than in new and unadulterated milk, *W. C. Williams*, 5149-54, 5300, 5392.

65. PHYSIOLOGICAL EFFECTS OF PRESERVATIVES :
65a. BORACIC ACID : Albuminuria :
Temporary, *Wild*, 1447.
Three cases known, *Wild*, 1462.
65b. BORACIC ACID : Digestion :
Interfered with, even by small doses, *Walford*, 1856-60, 1863-64.
Effect in food on digestive ferments studied, *Cripps*, 1936-39, 1974.
In 1 per cent. solution, no detrimental influence on salivary digestion, *Cripps*, 1940-44, 1948.
No retarding influence on peptic digestion, *Cripps*, 1944-47.
No retarding influence on rennet ferment, *Cripps*, 1952.
Action of borax and of boracic acid different, *Cripps*, 1949.
Using zymin as a digestive agent, slight retarding influence shown on digestion of strong boracic acid solution, *Cripps*, 1952.
As used in butter and cream no ill-effect produced, *Cripps*, 1958.
Decomposition of food in stomach retarded *Bond*, 3135-37, 3140, 3142.
Has little effect on food, *Foulerton*, 4160.
Boracic acid peppered on fibrous food at meal times, *Attfield*, 6502, 6513-15. No bad effects on digestibility of food noticed, 6503-4, rather the reverse, 6505-6, 6512. Action of certain bacteria inhibited, 6507-9. Stomach washed out and contents examined, 6502, 6510-11. Nothing much to be learned from bacteriological examination of the contents, 6516-19.
65c. BORACIC ACID : Eruptions :
In an adult patient taking 30 grains per diem, *Wild*, 1422-27.
No evidence of skin eruptions from antiseptic use of the acid, *Anderson*, 7192.
65d. BORACIC ACID : Excretion :
By kidneys as an alkaline salt, and free boracic acid, according to dosages, *Wild*, 1419.
Through the kidneys, *Attfield*, 6501, how much daily not known, 6502.
Boracic acid excreted by the kidneys, *Hutchison*, 6706.
65e. BORACIC ACID : Nausea :
Resulted from 120 grains taken in four hours, *Wild*, 1418.
Said to have been caused by 5 grain doses, *Stevenson*, 4821.
65f. BORACIC ACID : General Physiological Effects :
Upon the system, should determine the question of its use as a preservative, *Cripps*, 1952, 1954-55, 1959.
Different modes of administration, as a drug and in food, may account for divergent action on man, *Williams*, 2199, 2200.
Use in foods risky, *Handford*, 2281-82.
Some people continue use notwithstanding unpleasant effects, *Handford*, 2266.
Unpleasant effects come and go as it is used and disused, *Handford*, 2266.
Poorer classes may suffer from the acid without seeking medical aid, *Cameron*, 2583-84.
Effect on infants only, to be judged by experiments on kittens, *Annett*, 2666.
Effects on adults probably idiosyncratic *Annett*, 2666.

65. PHYSIOLOGICAL EFFECTS OF PRESERVATIVES—*continued.*

65f. Boracic Acid: General Physiological Effects—*continued.*

Studied, *Bond*, 3063.

Not necessary to know that drug was being taken by patient in food, but would like to know it, and fact of any drug being taken in a way to modify treatment prescribed should be known, *Bond*, 3067-69, 3074.

Drug not unsuitable for children, *Bond*, 3073.

Borax-packed bacon not known to have been harmful, *Bannister*, 3494.

Has little effect on digestibility of food, *Foulerton*, 4160.

Physiological action of boracic acid is to cause a certain amount of skin eruption, *Tubb-Thomas*, 4931. Medical profession generally ignorant of the injurious effects of boracic acid. Evidence in the pamphlet of the Boric Syndicate not altogether satisfactory, 4938-39. Harm held to result from administration as a drug too soon after food, 4939-40, and indiscriminate use objected to, 4941, as well as use unknown to the consumer, 4942.

Borax or boracic acid or both mixed in quantity just sufficing to preserve milk would probably be harmless to the majority of people up to four or five pints daily, *Hutchison*, 6759.

Borax and boracic acid studied as regards children, *Still*, 6784-86. In cases of $2\frac{1}{2}$ grains of each to a pint of milk looseness of bowels has resulted. In another case distinct benefit accrued. Has given $2\frac{1}{2}$ grains of each three times a day for epilepsy to older children, with good effect, when added with bromide, but looseness of bowels has in cases resulted, and in one instance the boracic acid had to be stopped, 6787-88.

65g. Milk, Boracised: General Physiological Effect:

No harmful results known, *De Hailes*, 3976-81.

As used, harmless to ordinary individual, but probably hurtful in cases of infants and invalids; but $\frac{1}{2000}$, 35 grains per gallon, would be safe for an individual taking a pint daily, *Foulerton*, 4047-49.

65h Boracic Acid: Affirmed Physiological Effects:

Alleged in a delicate lady, *Jones*, 1317-19, 1323-27, 1349-60, 1386-90.

Poisoning by, produces diarrhœa, vomiting, low temperature, and may much resemble chronic ptomaine poisoning, *Jones*, 1332-36.

Slight disturbance from continued doses of 15 to 20 grains, *Wild*, 1418.

In $\frac{1}{1000}$ in milk would result in loss of appetite and nutrition in baby, if continued, *Wild*, 1433-35.

Eruption and loss of hair, in 30 grain doses daily, *Wild*, 1422-27.

All results known from 10 grain doses, *Wild*, 1461-62.

Held to be detrimental to health, *McFadyean*, 1764-66.

Continuous daily doses of 30 grains would have ill-effect, *McFadyean*, 1770.

Long experimentation would determine the produced effect, *McFadyean*, 1796-97.

Though unobserved may be none the less injurious, *McFadyean*, 1798-99.

Inferential, *McFadyean*, 1775.

Objectionable because of unknown effect, *McFadyean*, 1802, 1815-16.

Interferes with digestion even in small quantities, *Walford*, 1856-60, 1863-64.

Held to have caused injury in food, *Williams*, 2112.

Absence of proof of injury in food may arise from failure of observation, *Williams*, 2196-98.

In internal use, an irritant, and causes loss of appetite, *Handford*, 2264-65.

Gastric disturbance has followed use in cystitis, *Handford*, 2285-87.

Evil results from borax-dusted meat, *Handford*, 2280.

Marked and hurtful, even fatal, *Hill*, 2339.

65. PHYSIOLOGICAL EFFECTS OF PRESERVATIVES—*continued.*

65h. Boracic Acid: Affirmed Physiological Effects—*continued.*

Inconvenience from preservatised food has arisen on many occasions, *Hill*, 2372.

Hearsay instances quoted, *Hill*, 2373, 2423.

Injury has followed internal use, *Hill*, 2421-22; *Mann*, 2607.

Indiscriminate use dangerous, especially as regards infants and invalids for whom it might be medicinally required, *Cameron*, 2535.

Injury has followed external use, *Mann*, 2607.

Injurious effects on infants held to be decided in amounts used on kittens, *Annett*, 2651-52.

Thirty grains per diem known to have produced severe symptoms, *Annett*, 2667.

Continued dosage harmful, *Boyce*, 2776.

Itching of skin in a few cases in dropsical old men with renal disease, *Bond*, 3083.

Thirty-grain doses daily would create pronounced skin itching and perhaps some eruption, *Bond*, 3087.

Injury held to have followed external use, *Robinson*, 3304.

Child taking 160 grains a day, as is possible in milk, would be injuriously affected, *Blyth*, 3467.

Prejudicial to children's health, *Bannister*, 3658.

Rash known to be produced by 20 grains, *Rideal*, 3692.

Nausea said to have been caused by five-grain doses, *Stevenson*, 4821.

Boracic acid as a preservative deleterious, *Kaye*, 5502. Dangerous to take 54 grains, 5506. Presumptive evidence obtains as to prejudicial effects of the acid, 5513.

Harmful effects of borax and boracic acid as medicines vouched for on much evidence, *Starling*, 6944. Infantile scurvy might be produced by borax, 6945. Unlikely that borax taken continuously can be other than harmful, 6955.

Boracic acid prescribed by witness, *Anderson*, 7186, 7210, and its effects observed, 7187. From 30 to 60 grains daily for bladder disease have frequently caused dyspeptic disturbances sufficient to cause misery, the symptoms quickly subsiding on the acid being given up, 7188. Serious dyspeptic trouble likely to accrue to child taking 10 grains a day in milk, 7204.

Milk preservatised known in a few cases to have caused derangement, *Womack*, 7474. A small amount of boracic acid in milk has caused digestive disturbance in individuals, 7475-77.

Borax and boracic acid have caused skin eruption and dyspepsia, *Halliburton*, 7541-49. Borax more readily soluble than boracic acid, 7543. Admixtures of both commonly used in the form of glacialine, 7544. Harmfulness of continued use of borax on kidneys held; mal-nutrition of infants fed on boracised milk instanced; digestibility of milk interfered with by minute doses of borax, but not of boracic acid, 7545, 7548.

65j. Milk, Boracised: Affirmed Physiological Effects:

Milk treated with boracic acid by a dairyman, and also with "glacialine" containing as its basis boracic acid by the cook, held to have led to serious illness of five of seven inmates of a house, the two who had not participated in the milk escaping. Milk taken alone, blended with tea, or in blanc-mange. Symptoms were vomiting, colic, suppression of urine, and great prostration. Of nine fowls which took the blanc-mange five pullets, which ate voraciously, died, *Robinson*, 3301, 3345; amount of milk taken by sufferers not known, 3342-43, 3346-47; the two inmates who escaped had a little milk in tea or coffee, 3314-16; crop and gizzard of fowl and the milk examined; blanc-mange not examined; boracic acid

65. PHYSIOLOGICAL EFFECTS OF PRESERVATIVES—*continued.*

65j. **Milk Boracised**: Affirmed Physiological Effects—*continued.*
held to have caused the illness, 3302; quantitative analysis of milk not made, 3303, 3305; boracic acid in large quantity found deep seated in fowl, 3303, 3344; symptoms such as would be expected from borax or boracic acid, 3304; all possible factors other than boracic acid eliminated as cause of illness, 3305, in the house in Dover, 3306; blanc mange deemed the cause of the illness, 3313; milk and blancmange both implicated, 3317; latter made of ground rice, eggs, sugar, boiled milk and vanilla flavouring, 3318–19; and the contained milk held to be special factor, 3320; but some other constituent may have been in question, 3321. Farm furnishing the milk visited, 3322; boracic acid added to the milk by the milkman, 3323–26; this and the added glacialine doing the harm, 3327; the milk would be consumed in other houses, but not known to have had glacialine also, 3328; and in this respect would differ. 3329; possibly, 3330–31.
Quite possible that cases of infantile diarrhœa and enteritis in the town may have had relation with the particular milk supply, 3332–33; possibility of preservatised milk having relation with infantile diarrhœa almost a conviction, 3334.
Dover poisoning by boracic acid not accredited, *Rideal*, 3778–80.
Case of illness of a child after one day's boracised milk diet, *Hope*, 6841, 6910–12.
Harm to infants from boracised milk known of, *Starling*, 6956.

65k. **Boracic Acid**: Negative Physiological Effects:
Continued doses taken without ill-effect, *Prossor*, 571, 574–81, 599–606.
No ill-effects heard of, *Trengrouse*, 702: as regards meat, *Gregson*, 915; *Sinclair*, 947 *Jones*, 1314, 1316.
Family use of boracised milk and butter large and continuous, *Lovell*, 809-15.
No ill-effects personally from 10-grain doses, *Wild*, 1416–17.
None from 5-grain doses, *Wild*, 1459–60.
None from single 30-grain dose by adult, *McFadyean*, 1768.
Thirty grains taken by some persons daily for long periods with seeming impunity, *Handford*, 2266.
Use in stomach not known to have caused ill-effects, *Handford*, 2284.
Beneficial when used medicinally in moderate doses, *Bell*, 2786; extreme instances of life saving by 30 grains daily, 2787, 2789; borax constantly sucked for years without ill-effect, 2787; no ill-effects would follow consumption of boracic compounds by community unknowingly, 2788; neither 40, 50 nor 90 grains daily dangerous, 2790–91, 2811, 2824–25; in a surgical case, with great absorption into system, several pounds used on raw surface without ill-effect, 2793–94; no ill-effects have followed absorption, 2796; no ill-effects from use known, 2834–36.
No ill-effects have followed use for months in bladder diseases, *Bond*, 3065.
No ill-results from external use, even in extreme case, *Bond*, 3097.
Harmless as used as a preservative, *Bond*, 3088.
Boracic acid taken by witness, 20 grains a day, for a fortnight continuously on full stomach produced no observed ill-effect at all, *Hutchison*, 6693–94, 6696–97; if witness has a weak spot it is his stomach, 6695; also 5-grain doses twice daily of borax and boracic acid solution, 2½ grains of each, for the same period had no ill-results, 6698–6700, 6712; inference that boracic acid or borax as used in milk consumed by an adult would be harmless to an average healthy man, 6701.

65. PHYSIOLOGICAL EFFECTS OF PRESERVATIVES—*continued.*

65k. **Boracic Acid**: Negative Physiological Effects—*continued.*
Harmful results of continued use of borax boracic acid read of, *Hutchison*, 6702; no bad effects noticed when borax used for short period for epilepsy, 6703; it was mixed with bromide; not known which did the good, 6704; might be dangerous to children to take 30 grains daily in milk, 6715–16; would not like to administer 80 grains of boracic acid in a pint of milk, but could not say it would produce ill-results on gastric cells, 6753–54; Leibreich's experiments known as to borax, boracic acid, and formalin, 6755; showing surprisingly little local effect on lower animals, 6756; adult dogs chiefly, 6757; and inference on puppies cannot be inferred therefrom, 6758.
No practical experience of harm from boracised food, *Anderson*, 7203.

65l. **Boracic Acid**: Poisonous Properties:
May arise from idiosyncrasy or kidney disease, *Wild*, 1463-66.
No cases known or heard of, *Walford*, 1867-69; *Hill*, 2415.
Unquestioned, *Williams*, 2195.
Studied experimentally, *Rideal*, 3680.

65m. **Preservatives**: General Physiological Effects:
Injury to health cannot be proved, *Williams*, 2133-34, 2183-86.
Not known to be injurious to health, *Williams*, 2146.
Injury to health may certainly arise, *Williams*, 2149-51.
Question of injury based on experts' statements, *Williams*, 2180-81.
Digestive disturbances not clearly defined, *Annett*, 2697.
Immunity as the result of repeated dosage an argument against preservatives, because of expense at which gained, *Boyce*, 2735-36.
Digestibility of food inappreciably affected by $\frac{1}{50000}$ of formaldehyde or $\frac{1}{2000}$ of borax and boracic acid mixture, *Rideal*, 3681-86, 3772-76.
Objections to preservatives lie in their chemical character, and action *quâ* decomposition of food in the human economy, *Faber*, 4205.
Injurious effects of preservatives on digestion inferred, *Long*, 4579. Salicylic acid held to arrest peptic digestion, and heavily boracised milk, 210 grains per gallon, to be injurious to a milk drinker, 4613, 4696. Illness alleged to be caused by preservatised milk, 4615-26. Preservative drugs in food objected to, 4627. Good deal of injury by preservatised food suspected, 4628.
If medical men were aware of the substances used as preservatives and the extent to which used, mischief thereby would be looked for, *Tubb-Thomas*, 5011. Parallelism of lead poisoning and ergotism, 5012-13.
Should be proved harmless if permitted to be used, *Corfield*, 5124-27.
Physiological experiments point to injurious effects of preservatives, *Kaye*, 5514-15, especially as to formalin, 5516-17. Preservatives to be effective must injuriously affect human delicate digestive organs, 5518, 5547-52. Boracic acid as a drug and as a preservative daily in use very different, 5552.
Physiological action of modern preservatives studied, *Attfield*, 6495, as used by witness for personal dyspepsia under medical advice, 6496.
Retardation of digestion of salted and smoked foods not due to antiseptics, *Attfield*, 6520.
Inhibitory action of preservatives on bacteria of decomposition and therefore also on digestion not true in witness's judgment, *Attfield*, 6546.
Continued use of a preservative might have tendency to diminish vitality of human body, *Starling*, 6987.

65. PHYSIOLOGICAL EFFECTS OF PRESERVATIVES—*continued.*

65m. Preservatives: General Physiological Effects—*continued.*

Relative value and harmfulness of preservatives need to be accurately ascertained, *Brunton*, 7431, over a length of time as to result of their continued use, 7432-36. Many of the preservatives may be as harmless as chicory in small quantity, but not in excessive quantity, 7442.

No evidence of ill results in St. Bartholomew's wards from small doses of preservatives, *Womack*, 7502, 7523-24. No good results reported, 7503. Staff generally hostile to preservatives, 7504, 7508, and against their indiscriminate use in food, 7505-6.

Physiological experiments form the basis of evidence to be given, especially as to boron compounds and formaldehyde. Continuous use of antiseptics objectionable on general principles, *Halliburton*, 7528. Even salt immoderately used has been injurious, 7529-30. Germicidal substances hostile to man in food, 7528-30.

65n. Preservatives: Affirmed Physiological Effects:

Might be distinctly injurious if of germ restraining power, *McFadyean*, 1752.

Proof would render them indefensible, *Walford*, 1872.

Held to be injurious, *Vasey*, 2101-6.

Prejudicial to digestive processes, *Hill*, 2511, 2515-17.

Haphazard administration most dangerous, *Hill*, 2518.

Interfere with digestive properties, *Cameron*, 2533, 2563-69.

Some undoubtedly injurious in themselves; some probably so; some retard or prevent digestion, *Mann*, 2604-5.

They inhibit the action of enzymes, *Mann*, 2617-19; *Annett*, 2697.

Digestive properties of food would be injuriously affected by effective preservative drugs, *Cassal*, 3813, 3872.

Digestibility of food must be inhibited if preservatives are effective, but experiments do not bear this out, *Corfield*, 5093-96.

Digestion at times affected by preservatives, *Grünbaum*, 6479.

Harm may accrue to young infants by use of preservatised milk, by way of retarded digestion. Kitten experiments demonstrate harm by boracised and formalised milk, *Hope*, 6830. A case of illness in a child by one day's boracised milk diet, 6841, 6910-12. Very serious harm will result to infants if the "humanised" milk now sold as pure milk is preservatised, 6879, and this may result despite practicable precautions, 6880-83. Harm looked for if boracic acid administered in scarlet fever and kidney disease, 6893. Harm to infants from preservatives difficult to trace, 6908-9. Relation of preservatives to infantile diarrhœa not traced, 6922.

Preservatives in certain cases harmful, and want of fresh food harmful to health of community, *Poore*, 7340. Scurvy follows prolonged use of preserved food, 7341, 7414-17. Food chemically preserved might be positively harmful, 7342; but ignorance at present obtains as to the action of chemical preservatives, 7341, 7349. No reason why chemical treatment of food should not be innocuous, 7421-22. Preserved vegetables have failed to prevent scurvy, 7343. Scurvy decreasing by reason of added precautions, 7344. Even preservatised lime juice has failed as an anti-scorbutic, 7345.

65o. Preservatives: Negative Physiological Action:

No ill-effects known, *Boseley*, 1047-48.

65p. Formalin: General Physiological Effects:

No experiments made, *Boseley*, 1001.

Opposed to life, *McFadyean*, 1792-95, 1806-10.

Inference from Chittenden's experiments in dogs in normal health, that no harm would accrue to adults from formaldehysed milk, *Boyce*, 2733-34.

65. PHYSIOLOGICAL EFFECTS OF PRESERVATIVES—*continued.*

65p. Formalin: General Physiological Effects—*continued.*

Non-irritation at a manufactory would speak well for modern methods employed, *Boyce*, 2771.

Formic aldehyde used in bladder diseases in 10-grain doses thrice daily, as a preparation of formic acid and ammonia, called "urotropine," *Bond*, 3123-29, 3132-34.

Potency and action inside the body not known, *Brierley*, 3216-17, 3223-28.

Hardening effect on fish not known, *Brierley*, 3231.

Rideal quoted as showing less interference with digestion by formalin than by boracic acid or alcohol, *Brierley*, 3219.

Dangerous, acts directly on milk curd, is a poison, and an antiseptic, *Bannister*, 3659-60.

Negative evidence not of much worth in face of positive evidence, *Cassal*, 3833.

Formic aldehyde would perhaps render milk a little less digestible, *Foulerton*, 4047-49.

Use for persons on milk diet injurious, but not for ordinary persons, *Foulerton*, 4146.

As a preservative has but little effect on digestibility of food, *Foulerton*, 4160.

Formalin in milk in very small doses as affecting the organism, not known of, but harmful properties suspected, *Fisher*, 4729-31, 4738.

Effect on peptonised milk for invalids suggested as matter for inquiry, *Fisher*, 4743.

Hardening effects of formic aldehyde known, and dangerous properties pointed to, *Fisher*, 4754-60, 4765-66.

Affects digestion, *W. C. Williams*, 5216-17; in milk, *Richmond*, 5652-58.

Kills micro-organisms, *Richmond*, 5742; in relatively strong solutions, 5748; and is a disinfectant, 5744.

Local irritant, *Hutchison*, 6741.

Harmful results may accrue from formalin as a preservative, but no considerable harm probably, *Still*, 6816. It would interfere with digestion if long continued. Chary of letting children have anything containing it, 6817.

Formalin takes away food character of proteids, *Starling*, 6939. In $\frac{1}{5000}$ formalin stops the action of pancreatic juice, 6963; not tested as to $\frac{1}{10000}$, 6964.

Objections to formalin based on experiments showing its effect upon proteid and digestive activity, *Starling*, 6965-66.

65q. Formalin: Affirmed Pyhysiological Effects:

Held to be injurious, *Lovell*, 806.

Renders food indigestible, *Voelcker*, 1817.

Retards digestion of food, *Mann*, 2607. Experiments show arrestive action on pancreatic ferments, *Mann*, 2619. A blood poison in large doses, *Mann*, 2629-32.

Injurious effects on infants regarded as decided in amounts used on kittens, *Annett*, 2651-52.

In milk, inferred, even in small proportion, *Boyce*, 2724-25. A great irritant, its action inhibitory; lowers the cell vitality, has direct action on enzymes, and affects digestion by way of food, *Boyce*, 2751-52, 2754-57.

Raw, has a hardening effect, on certain tissues, but in quantity used, 0·012 per cent., effect infinitesimal, *Brierley*, 3220-21.

Hardening effect stated on foodstuffs would if appreciable affect their digestibility, *Brierley*, 3232-35.

Dangerous substance even in small amount, injuriously affecting digestion, and having very hardening properties, *Cassal*, 3831-32.

Digestive properties of food would be affected injuriously by any quantity sufficing to preserve milk, *Cassal*, 3873-74.

Injurious if taken continuously, *Tubb-Thomas*, 4978.

Personal experiment, $\frac{1}{5000}$, resulted in illness, *Hehner*, 5612-13.

65. PHYSIOLOGICAL EFFECTS OF PRESERVATIVES—*continued.*

65q. FORMALIN: Affirmed Physiological Effects—*continued.*
  Formalin not known from physiological point of view, *Womack*, 7483-84, but its indiscriminate use objected to, 7485, as interfering with digestibility of food, 7486. It might act on secreting power of cells, 7489. It is a hardening substance, 7490, and its use should be limited, 7491. Objected to by St. Bartholomew's medical staff in milk and butter, 7500-1. Formic aldehyde for hardening substances used in much higher proportion than as a preservative, 7513-15. The compound formed with proteids by formic aldehyde will be indigestible, 7516, and the formic aldehyde would render milk indigestible, 7517-18, and should be largely under restriction, 7519.
  Formaldehyde a marvellous antiseptic and inhibitive of digestion in minute quantities, *Halliburton*, 7548. Is absolutely opposed to its use, 7572; and the indigestibility of food by its use held to be proved by experiments *in vitro*, 7583-85.

65r. FORMALIN: Negative Physiological Effects:
  Family have used formaldehysed milk for two years without injurious effect, *Brierley*, 3229, 3255.

65s. SALICYLIC ACID: General Physiological Effects:
  Thirty grains in alcohol less harmful than the alcohol, *Bond*, 3119-22.
  Injury to individuals may result from indiscriminate use of salicylic acid, *Stevenson*, 4810.
  Non-injury of many not conclusive of non-injuriousness, *Stevenson*, 4824-25.
  Salicylic acid stops the action of certain enzymes, *Richmond*, 5745-46.
  Salicylic acid is less harmful than formalin, but is apt to cause stoppage of gastric digestion in the stomach, *Starling*, 6941. It is a potent drug, and should not be used unknown in food stuffs, 6942.
  Little known to witness, *Halliburton*, 7571.

65t. SALICYLIC ACID: Affirmed Physiological Effects:
  Used medicinally, acts powerfully on liver; is a depressant, usually taken in form of salicylate of soda; in large doses produces weakness and sickness; sometimes causes poisonous symptoms, *Cameron*, 2546.
  Causes internal disturbance if in cider persistently consumed, *Mann*, 2611.
  Delirium as caused by, not known, *Bond*, 3107, 3110-11.
  Affects individuals injuriously, *Stevenson*, 4823.
  Used externally, irritates, and a most undesirable substance in food, *Corfield*, 5073-74. People ought to know they are taking it, 5075; continuous use possibly cumulative, 5076-77; and hence more seriously effective, but acquired immunity possible, 5078-79.
  Salicylic acid, as salicylate of soda, produces distinctly unpleasant symptoms, *Anderson*, 7211-12.

65v. SALICYLIC ACID: Negative Physiological Effect:
  No ill-result with 10-grain doses, *Bond*, 3105-6.
  Given in bladder diseases, *Bond*, 3107.
  Suits witness for gout, *Robinson*, 3340.

66. POISONS:
  Not defined by statute in relation to foods, *Cassal*, 3789-94.

67. PRESERVATIVES:

67a. COMPOSITION:
  Examined, *Voelcker*, 1636-39, 1652.
  Foreign to the body, *McFadyean*, 1756, 1778-81.
  Five, listed, were compounds of borax and boracic acid, or pure boracic acid, *Kaye*, 5455-57.

67. PRESERVATIVES—*continued.*

67a. COMPOSITION—*continued.*
  Always boric compounds found in butter, *Hehner*, 5566.
  Preservatives in general use principally boric compounds, *Richmond*, 5643. Analysis handed in, 5644-45. Salicylic acid, soda and magnesia in a glycerine solution also in question in two samples of preservatives, 5545. Formaldehyde also used, 5647. Difference between boracic acid, formic aldehyde, and salicylic acid in dilute solution, one of degree, but in strong solution, one of kind, 5747. Fluorides not found, 5749. Hydro-fluoric acid in large quantity found experimentally to be the most perfect preservative for milk; and fluoboric acid extremely strong preservative, 5750; data promised, 5751-52.

67b. CURE:
  Not effected in meats, apart from salt and saltpetre, *Davidson*, 1586-88, 1610.

67c. DISTRIBUTION:
  Unequal, a barrier to standardising, *Vasey*, 1999-2001, 2003.

67d. FOREIGN LAW AND PRACTICES:
  Continental legislation as to food inquired into, *Grünbaum*, 6407; principally in Germany and Austria, 6408; as to preservatives in food, 6409.

67e. AMERICA:
  Prohibition of preservatives in milk absolute in New York State, *Hill*, 2452-53.

67f. AUSTRIA-HUNGARY:
  Prohibition of preservatives in milk absolute, *Hill*, 2454.
  Prohibition of boracic acid in force in Austria, *De Hailes*, 4006; also salicylic acid, *Corfield*, 5098-5100.
  Prohibition of preservatives believed to exist in Austria, *Boyce*, 2745.
  Vienna has bye-laws prohibitory of preservatives in food, milk being especially in question, and sodium carbonate being included in the prohibition, *Grünbaum*, 6421-22, 6464. Ministerial decrees in Austria prohibit specified preservatives and colouring matters, 6426-27. All preservatives are prohibited in milk, and Hungary is seeking to prohibit all preservatives, 6428. Present action in contemplation in Austria not known, 6429-30. In Vienna only one sample of milk in one year found to be preservatised, and that by a large quantity of sodium carbonate, 6463. Preservatives forbidden in beer in Austria, 6468-69. No evidence as to use of saccharin procured, 6475.

67g. BELGIUM:
  Prohibition of preservatives in milk absolute, *Hill*, 2454.
  Preservatives prohibited, *Boyce*, 2741-42.

67h. CANADA:
  Prohibition of preservatives in force, *Riley* 819.

67j. DENMARK:
  Saccharin in wine and beer allowed only if declared on label, *Faber*, 4206.
  Prohibition of salicylic acid, boracic acid, and certain mineral salts in wines and spirits in Denmark, *Faber*, 4206, including salts of aluminium, barium, strontium, and magnesium, 4207. Salicylic acid prohibited since 1886, 4208. That and boracic acid prohibited as injurious to health, 4208-9, 4266, 4354-56, it being felt also easier to prohibit borax in butter prior to its use becoming general, 4267, and thus probably dangerous by use in many articles of diet, 4268-70. Only common salt allowed in dairy produce in Denmark, and no inconvenience results, 4210-11, even in Copenhagen, 4212-15. Prohibition of borax in butter had rather a present element of injury to trade, though a probable prospective advantage, 4271-75.

67. PRESERVATIVES—*continued.*

67k. France:
Regulation strict, *Hudson*, 521-22.
Prohibition of preservatives enforced on American bacon and ham, and withdrawn in 1899, *Hudson*, 505, 523.
Prohibition of boracic acid in butter used in France, *Williams*, 2218-20; *Hehner*, 5619-22.
Butters exported from France are preservatised, *Williams*, 2218-20; *Richmond*, 5684.

67l. Germany:
Preservatives prohibited, *Boyce*, 2741-42.
Prussian ministerial circular totally prohibitive of preservatives in food, *Grünbaum*, 6410; and local bye-laws made in the same sense. Preservatives in milk totally prohibited, 6411, 6413-14, 6432; as also in wines, 6411-12. Milk dealt with on account of impossibility of fixing standards for the kingdom, 6415; and because harm from use of preservatised milk was feared, 6433-34; especially as to children, 6435. Proceedings taken at Hamburg and elsewhere as to preservatives in milk, 6416-17; and as to sodium sulphite in minced meat, 6418; the substance being injurious to health in small amount, 6419-20. Germany seeking to prohibit preservatives in meat, 6423. Experiments were made as a basis for existing legislation, 6436-38, 6442, 6465. Formalin used, but very rarely found, 6439; the same as to salicylic acid, 6440; as regards milk, 6441. Expert evidence has been taken in Germany as to results following the administration of sodium sulphite, 6442, 6445; namely, headache, diarrhœa, indigestion, and catarrh, 6446; even in small doses, 6447. Found in minced meat, a food for invalids, from 0·08 to 0·86 per cent.; not found in milk, 6444-45, 6447. Medical profession against preservatives, 6457-58; on general principles, and as not knowing when patients were taking them, 6459. Berlin milk supply unpreservatised, 6459-62. Distribution in closed vessels, 6470-72; and in bottles in the smaller towns, 6473-74. Evidence as to preservative legislation mainly concerned with milk and minced meat, 6466. Preservatives forbidden in beer in Germany, 6467, 6469. Milk sent by rail in ice-cooled vans, 6477.

67m. Norway:
No law known against use of preservatives in butter, *Lovell*, 755-58.
Practice as to preservatives not known, *Faber*, 4312-15.

67n. Sweden:
No law known against use of preservatives in butter, *Lovell*, 755-58.
Practice as to preservatives not known, *Faber*, 4312-15.

67o. Switzerland:
Prohibits borax and boracic acid in imported meat, *Grünbaum*, 6423-25.
Prohibition of preservatives in milk in parts of the country, *Hill*, 2454.

67p. Medical Profession:
Medical profession do not regard preservatives in food seriously, *Hutchison*, 6727; nor do the hospitals, 6728. Physicians practice not stultified by preservatised milk, 6729; unless boracic acid were both prescribed, and also in the patient's milk, 6730; as also with salicylic acid, 6731. Medical profession affected in this sense, 6732-35. The uncontrolled use of preservatives would be a bad thing from medical men's point of view, 6736.
Indiscriminate use of drugs as preservatives might be of serious moment for medical profession, *Still*, 6806, 6810; especially as to salicylic acid, 6808-9; but borax and boracic acid rarely used, and formalin never used internally, 6807. Physicians should know accurately the amount of drugs taken in food, 6810.
Physician should know composition of milk taken by a patient, *Hope*, 6894. He might stultify himself, 6895.

67. PRESERVATIVES—*continued.*

67p. Medical Profession—*continued.*
Use of preservatives of interest to medical profession, especially as to salicylic acid, *Starling*, 6967; in cases of rheumatism, for example, when results might prove to be very serious, if the amount taken also in food, 6968, 6970; salicylate of soda being in question, 6969.
Medical men should know if patients are taking drugs in their food, *Anderson*, 7197, 7204. Their position might be stultified, 7198. Harm caused by milk in one instance, 7198-7202.
Matter of preservatives an important one to medical profession, *Brunton*, 7456-57. Practice of physician might be stultified by their use, 7458-62. Present committee hardly in a position to give a pronouncement as to preservatives, 7466.

67q. Power of Preservatives:
Limited, and the fact important, *Vasey*, 2004, 2056-57.

67r. Public:
Not self-protected against, *Vasey*, 2065-66.
Should be able to purchase unpreservatised food, *Vasey*, 2003, 2052, 2078.
Not generally aware of their use, *Cameron*, 2532.

67s. Supply of Preservatives in Butter:
From Limerick chemists, *Sandes*, 98.
Obviate glutting the market, *Shanahan*, 413-14.

68. PRESERVATIVES, USE OF:

68a 1. Boracic Acid:
For meats, ham, bacon, sausages, herrings, &c., *Hehner*, 5623-27.

68a 2. Boracic Acid: Bacon:
Dusted over mild-cured meat, *Prossor*, 563; *Davidson*, 1588-89.
Used during salting, *Prossor*, 556, 569.
Washed off after cure, *Prossor*, 556, 569, 590-91; *Davidson*, 1588-89.
Retained, 7 to 10 days, till cure complete, *Prossor*, 582-87.
Not advocated, but demanded, *Gregson*, 903.
After cure, *Davidson*, 1588-89.
By external rubbing or laying on, and so also in ham, *Hill*, 2354-55.
Borax packing used in American and Canadian bacon trade, *Harris*, 5961.
Not personally objected to, *Harris*, 5980.
Much the larger part of bacon coming to English consumer is borax-packed, *Harris*, 6018.

68a 3. Boracic Acid in Butter: Admixture:
Intimate, *Trengrouse*, 625, 628.

68a 4. Boracic Acid: Butter: Detectable:
Flavour imparted only by large quantity, *Trengrouse*, 658.
Tasteless in small quantity, *Lovell*, 806.
Over 1 per cent., *Lovell*, 723, 983-89.
By taste, *Clement*, 1532-34.
Even ¼ per cent., if butter be not keeping, *Clement*, 1535.
Not always, *Clement*, 1537-39.
One per cent. detectable, *Clement*, 1540.

68a 5. Boracic Acid: Use in Butter:
Alone or blended, *Sandes*, 81, 82.
Basis of all preservatives, *Dale*, 243.
Called Preservitas, *Dale*, 271.
Mixed with the butter, *Dale*, 244, 251, 278-79, 318-20.
Dissolves in butter, *Dale*, 282.
Used to be added in solution, *Shanahan*, 349, 351.
Frequent, *Cameron*, 2527; *Cassal*, 3850-51.
Found in mixtures of margarine and butter, *Cassal*, 3852.
Used especially in summer, *W. C. Williams*, 5171.
Objected to, *W. C. Williams*, 5218-20.
Can be condoned only in annually diminishing quantity to vanishing point, *Hehner*, 5615.

68. PRESERVATIVES, USE OF—*continued.*

68a 6. Boracic Acid : Milk :
Use decreasing, *Hill*, 2340, 2383-84.
May have reference to supply and demand, *Hill*, 2394-96.
In skimmed milk, *Hill*, 2364.
Unnecessary, *Hill*, 2461-66, 2470; *Cameron*, 2579.
Use frequent, *Cameron*, 2527.
Attitude of medical profession towards, will depend on the finding of the Committee, *Cameron*, 2583.
More frequent than formaldehyde, *Mann*, 2608-10.
Found in milk, *Annett*, 2636-39.
More beneficial than harmful, *Bell*, 2814, 2826.
Used by Glasgow Dairy Co., *Bell*, 2787.
More in summer than winter, *Blyth*, 3439, 3442.
Country milk not so treated 20 years ago, much London milk not treated now, but retail dealers in poorer parts create a difficulty, *Blyth*, 3454-57.
Unpreservatised milk should be procurable, *Blyth*, 3458.
Found in London hospital milk, *Cassal*, 3821.
Advocated as best and safest, *De Hailes*, 3916.
Recommended in "Applied Chemistry," issued nine years ago, *De Hailes*, 4041-43.
In Guy's Hospital milk on one occasion, *Stevenson*, 4798.
Milk of high class dairymen not so much boracised as "over-day" milk vendor, who may doctor milk already treated, *Tubb-Thomas*, 4932. Boron compounds also used in private houses, 4933.
Recklessly used, and trade by its use improperly carried on, *Tubb-Thomas*, 4942-46.
Most in winter, when milk valuable, *W. C. Williams*, 5157, but data few, and basis of statement not of much importance, 5197-5215.
Milk largely treated in summer, but free in winter, *Kaye*, 5444-46.

68a 7. Boracic Acid : Milk : Admixture :
Not always intimate, tending to vitiate analyses, *Walford*, 1902-3.
Generally added by wholesale purveyor, farmer, or middleman, *Hill*, 2336-37.
Three separate additions may be made, *Hill*, 2338.
Saturated solution easy of uniform distribution, *Bell*, 2827-28.
Acid sold largely by chemists without instructions as to use, *Brierley*, 3214.
Some portion might contain overdose, *Bannister*, 3634.

68a 8. Boracic Acid : Milk : Application :
Powdered borax, *Walford*, 1901.

68b 1. Borax : Use as bacon preservative :
For last 20-25 years, *Kellitt*, 13, 14.
In increasing quantity in place of very salty American bacon, *Kellitt*, 15, 29, 33, 35.
Reduces excess of salt, *Kellitt*, 15, 73, 74.
Sprinkled only on shoulder of Irish and Danish bacon, *Kellitt*, 68-69.
Not noticed in English and Irish bacon as in Canadian, *Bennett*, 135.
For packing American and Canadian bacon, *Prossor*, 594, *Trengrouse*, 618.
Washed off on arrival, *Prossor*, 597; *Trengrouse*, 619.
For preserving bacon, after cure with salt and saltpetre, *Bannister*, 3484.
Essential, under present conditions of trade and demand, *Bannister*, 3495-3500.

68b 2. Borax : Butter :
Washed with solution in France and Australia, *Bennett*, 194-98.
Boraxed wrappers for French butter, *Bennett*, 199.
Boraxed wrappers effective, *Bennett*, 202-3.
Boraxed wrappers advised even for Colonial butter, *Bennett*, 208, 214.
No mixture, *Bennett*, 200, 201, 209, 219-20.
No conditions stipulated as to French butter, *Bennett*, 210.

68. PRESERVATIVES, USE OF—*continued.*

68b 3. Borax : Butter, Irish :
No mixture known, *Bennett*, 219, 220.

68b 4. Borax and Boracic Acid :
Becoming more general, *Boseley*, 986.
Unknown to consumer, objected to, *Jones*, 1313.
Should not be used in food, *Walford*, 1826-27.
Increasing, *Walford*, 1854-55; *Brierley*, 3210-11.
May lead to lack of cleanliness, *Walford*, 1839.
Most frequently used, *Vasey*, 2037.
Utterly bad in principle in foods, *Williams*, 2112.
Varies with season, and greatest in hot weather, *Williams*, 2141-43.
Decreasingly found in food in County Glamorgan, *Williams*, 2239.
Most frequent preservative in foods which are decomposed, *Hill*, 2436-40.
Indiscriminate use in food hampers medicinal treatment by the medical profession, *Hill*, 2460.
Not to be compared with salt as a preservative, *Mann*, 2628.
Should be controlled as to quantity, *Bond*, 3088, 3112.
Found in a variety of articles, *Cassal*, 3816.
Used for dusting poultry, also used in sausages, up to recommended quantity, 80 grains per lb., *Tubb-Thomas*, 4938, 4973-74.
Boric syndicate pamphlet issued with one object in view, and is a collection of data, leaning one way, towards favouring boric compounds, *Tubb-Thomas*, 4989-92.
Should not be used in food unknown to consumers, *Corfield*, 5075.
Not a food, *Corfield*, 5081.

68b 5. Bacon :
Packing keeps it mild, *Gregson*, 894-95.
To surface only, in a dry state, after cure, *Gregson*, 865-66, 891-93, 900-1.
Complaints have had relation only to incomplete removal in washing, *Gregson*, 874.
Practically all washed off here, *Sinclair*, 945.

68b 6. Bacon, American :
For 75 per cent. of meat, *Gregson*, 859, 876.
All washed off on arrival, *Gregson*, 867, 869-70.
Retention would flavour bacon, *Gregson*, 868.

68b 7. Bacon, Canadian :
For 75 per cent. of meat, *Gregson*, 859, 876.

68b 8. Butter :
Has improved manufacture, *Shanahan*, 385-86.
None used by Armour & Co., *Trengrouse*, 651.
Does not conceal defects, *Trengrouse*, 655.
May be repeatedly added, *Trengrouse*, 659, 662.
Creamery butter not dosed twice, *Trengrouse*, 664.
Only known preservative, *Lovell*, 715.
These only answer all purposes, *Lovell*, 806.
Used in all imported butters, *Lovell*, 782.
Frequently, some home, some colonial, *Voelcker*, 1653.
Only preservatives found, plus salt, *Voelcker*, 1654; *W. C. Williams*, 5169-70.

68b 9. Butter, Australasian :
Australian washed with solution, *Bennett*, 194–98.
Rancidity obviated in Australian, *Bennett*, 199.
Two per cent. found in some Australian, *Trengrouse*, 647–48.
Requisite, *Trengrouse*, 653, 673.
Unsalted but with boracic acid, *Trengrouse*, 621–22.
Requisite to prevent rapid deterioration after removal from cold store, *Trengrouse*, 624.
Australasian butter imported from Australia with, and from New Zealand without, preservatives presumably, *Riley* 828–29, 832, 834–35, 837–53.

68 PRESERVATIVES, USE OF—*continued.*

68b 9. BUTTER, AUSTRALASIAN—*continued.*
Requisite, *Clement*, 1503–5 ; *Voelcker*, 168 1720–22, 1730–32.
Expected to contain, *Davidson*, 1593.
Believed to contain, *Davidson*, 1597–98.
Proportion boracised not known, *Voelcker*, 1684–85.

68b 10. BUTTER, FRENCH :
Washed with solution, *Bennett*, 194–98.
Rancidity obviated, *Bennett*, 199.
Comes in wrappers soaked in solution, *Bennett*, 199.
No mixture, *Bennett*, 209.
No conditions stipulated, *Bennett*, 210.
Probably used, *Trengrouse*, 627.
Found in solution in factory butter, *Boseley*, 958–63.
Found in butter, *Boseley*, 1031–32.

68b 11. FOOD :
Both found, *Vasey*, 1987–88.

68b 12. MILK :
Added varyingly from $\frac{1}{1000}$ to $\frac{1}{10000}$, *Boseley*, 953.
Utility of $\frac{1}{10000}$ doubtful, *Boseley*, 954.
Amounts above $\frac{1}{10000}$ frequent, *Boseley*, 958.
Objected to, *Jones*, 1313.
Would retard commenced decomposition, *Jones*, 1366–69, 1374–75.
Might prevent detection of commencing decomposition, *Jones*, 1369 ; *Wild*, 1481–83.
Would not mask decomposed milk, *Jones*, 1370–73.
In $\frac{1}{30}$ would wholly retard decomposition, *Jones*, 1376–77.
May safely be used in small amount save for infants or in kidney troubles, *Wild*, 1429, 1444.
In small amount better than no milk or sour milk, *Wild*, 1440–41.
Seasonal, *Wild*, 1484.

68c 1. FORMALDEHYDE IN FOOD : Use :
Raspberries known to be sprayed with formaldehyde, *Boseley*, 970.
Increasing, *Vasey*, 2041 ; *Brierley*, 3210–11 ; in milk, *Hill*, 2349, 2383–84 ; and is a dangerous preservative, *Hill*, 2333, 2342, 2418–20, 2443.
Never used in butter, *Hill*, 2350, 2439.
Stronger than boracic acid and used in smaller amounts, *Hill*, 2386, 2441–42.
Injurious effects not known, *Hill*, 2387, 2416–17.
Not known of, *Cameron*, 2558.
Not justifiable but possibly harmless in foods, only occasionally used, *Mann*, 2626–27.
Used in a few samples of milk, *McCracken*, 2932.
Recommended four years ago, $\frac{1}{10000}$, *Cassal*, 3835–36.
Largely used, *Richmond*, 5647–49 ; *Hutchison*, 6740.
Objection lies to the indiscriminate use of formalin, *Attfield*, 6567.
Formaldehyde, a marvellous antiseptic, *Halliburton*, 7548. Commercial formaldehyde known to be used in milk in $\frac{1}{2000}$, 7586–88.

68c 2. MILK :
Found in milk, skim milk and separated milk, *Cassal*, 3816.

68c 3. FORMALIN :
A 40 per cent. solution of formaldehyde, *Boseley*, 952 ; *Cassal*, 3831–32.
Schering's solution in demand when boracising of food was locally prohibited, *Jones*, 1393.
Should not be used in food, *Walford*, 1826–27.
May have replaced boron preservatives, *Williams*, 2240–41.
Used since and because boracic acid detected in milk, *Robinson*, 3311.
Company vending formalin recommend $\frac{1}{50000}$ for milk, but that they always advised use of limit of $\frac{1}{50000}$ not known, *Foulerton*, 4082–85, 4107.
Sold to trade in one, and used also in 40 per cent. solutions, *Richmond*, 5648.

68. PRESERVATIVES, USE OF—*continued.*

68c 3. FORMALIN—*continued.*
Formalin has an extremely hardening effect on gelatine in strong proportions, *Attfield*, 6521–30, 6566 ; of 40 per cent. solution, 6531. As a constituent of food, action not known, 6567.

68c 4. FORMALIN : Dairy Products :
Frequently used, *Boseley*, 951–52.
Equally general with borax, *Boseley*, 989
Has preserved several samples of milk, *Boseley*, 990. Amounts used experimentally in milk, $\frac{1}{2000}$ to $\frac{1}{10000}$, *Boseley*, 992, 995. Amounts generally used in milk unknown, *Boseley*, 993. Minute traces found, *Walford*, 1840.
Persists in milk, *Boseley*, 994.
Formalised milk gives reaction with litmus paper, *Boseley*, 998–99.
Renders milk indigestible, *Voelcker*, 1817.
Found in milk, *Annett*, 2636–39.
Increased use would render milk unsaleable, *Boyce*, 2774.
May alone be permitted in milk ; only a small quantity is used ; large dose would make milk smell unpleasantly, *Brierley*, 3182.
Added regularly, in summer only, by one dealer, *Brierley*, 3188.
Preferred to boracic acid, *Brierley*, 3215.
Never found in butter, *Hehner*, 5610.
Milk vendors use formalin and borax-boracic acid equally, *Richmond*, 5650.
Small quantity only required to preserve milk, *Hutchison*, 6742.
In $\frac{1}{2000}$ would not flavour milk, *Halliburton*, 7586–90.
More in imported French than in English milk, *Brierley*, 3236–43, 3268–73.
Should not be used in milk, *Bannister*, 3660.
Found in milk, skim milk and separated milk, *Cassal*, 3816.
Objects to $\frac{1}{50000}$ in milk, *Cassal*, 3875.
Does not think milk with $\frac{1}{10000}$ would be undrinkable by reason of taste, *Cassal*, 3375–77, and footnote.
For ordinary individual taking a pint of milk daily, $\frac{1}{50000}$ safe, *Foulerton*, 4048–49.
Formic aldehyde, a powerful poison in undiluted form, but not poisonous as used in milk, *Foulerton*, 4139–40.
In $\frac{1}{10000}$ would lead to consumption of liquid, fatal to fish in five hours, *Foulerton*, 4141.
Altogether objected to in milk ; if allowed quantity should be very minute, *Stevenson*, 4829-31.
Getting more used, *Tubb-Thomas*, 4975-76.
Used in milk less frequently than boracic acid, *W. C. Williams*, 5160.
Enables stale milk to be sold as fresh, and puts a premium on cleanliness, *Williams*, 5218.
Largely used in summer but not in winter, *Kaye*, 5444-46.

68c 5. MILK :
Formic aldehyde should be prohibited in milk Purchaser may be prejudiced by formaldehysed milk, *De Hailes*, 3966-67.

68d 1. PRESERVATIVES :
Have largely superseded salt, *Lovell*, 714.
Not deemed necessary by Aylesbury Dairy Company, *Boseley*, 1018-21.
Prejudice against food so treated had by some people, *Copeman*, 1204-5.
Permit of unsaleable goods being sold, *Voelcker*, 1714-15.
Should be scheduled after inquiry, *Foulerton*, 4167.
A changing quantity, *Foulerton*, 4168-69.
Studied in food, *Stevenson*, 4797 ; *W. C. Williams*, 5147.
To be avoided as not food, *Corfield*, 5123.
Studied in milk and butter recently and specially as regards West Riding, with a population of over one million persons, and investigation to be continued, *Kaye*, 5437-42, 5496.
Studied extensively, in food, *Hehner*, 5564.

68. PRESERVATIVES, USE OF—*continued.*

68d 2. PRESERVATIVES: Use, General:
- Apart from salt objectionable, and foreign to the body, *McFadyean*, 1756, 1778-81.
- Time not a factor, *McFadyean*, 1783-87.
- Discarded in some instances by vendors as a result of examination made for "Lancet," *Vasey*, 1978-85.
- Increasing, *Vasey*, 1995.
- Boracic acid most frequently used; then salicylic acid, formaldehyde, and in a few instances benzoic acid, *Vasey*, 2037-40, 2043.
- Dates of first known use, *Vasey*, 2079-85 (App. No. 10).
- Increasing, but not much known to medical men; hence results of use not generally known or traced, *Handford*, 2277, 2296-99.
- Formaldehyde and boracic acid found, *Boyce*, 2711.
- Found only in milk, wine, and beer; and only formalin and boracic acid found, save as regards wine, in which was salicylic acid, *Brierley*, 3169-70, 3191.
- Increasing, especially of late, *Brierley*, 3173, 3207-9.
- Not much in use prior to 1875, *Brierley*, 3274-77.
- Statement prepared and handed in, *Lowe*, 3296-97 (App. No. 16).
- Studied, *Robinson*, 3300.
- May be taken in many foods in a day, *Robinson*, 3336.
- Boracic acid, borax, salicylic acid, and formaldehyde in common use, the latter a stronger antiseptic than the first, *Blyth*, 3439, 3463.
- Widespread for keeping foods saleable, and for palming off stale, inferior, and even bad articles, *Cassal*, 3802.
- Used for foods other than milk, but not so necessary, *Foulerton*, 4068-69.
- Boric compounds, formalin, and salicylic acid most commonly used, *W. C. Williams*, 5148.
- Increasingly in use, *Kaye*, 5444.
- List of five handed in with data as to use, *Kaye*, 5455 (App. No. 30).
- Recklessly used, *Kaye*, 5462.
- Fairly generally used throughout the country; but less among co-operative societies doing a quick trade, *Kaye*, 5473. Use of preservatives known as general during past seven years, 5482. Present knowledge of extent of use not very great, 5495, but hope held of further information resulting from prolonged inquiry, especially as to seasonal use, 5496-97.
- Preservatives are of use in the interests of public health, *Hutchison*, 6719, 6768.
- Becoming more common in every-day articles of food, *Hope*, 6840. Same objection does not lie as with milk and cream, 6841.
- Heard of as being most in use are formalin, salicylic acid, boracic acid, and borax, *Starling*, 6935-37.

68e 1. BACON: Preservative:
- Washed off on arrival, *Hudson*, 506-8.
- Little used in English bacon and ham, *Hudson*, 505.

68e 2. BACON, American:
- Used, *Hudson*, 505.
- Tend to increase trade, *Hudson*, 517-18.
- Borax dusted over pork coming in large and increasing quantity from America: procedure not deemed objectionable, *Hope*, 6878.

68f. BEER:
- Ten grains of salicylic acid per quart harmless, *Bond*, 3118.
- Most often by sulphurous acid, in small quantity; acid also used for cleaning brewery vessels, *Bannister*, 3661-62, 3668-70.
- Salicylic acid not used in this country; one case of lager beer salicylised, *Bannister*, 3663-64, 3666, 3671.
- Bottled beer needs no preservative, *Bannister*, 3366-67.

68. PRESERVATIVES, USE OF—*continued.*

68f. BEER—*continued.*
- Beer as preservatised subject of evidence before Beer Materials Committee of 1898, *Schidrowitz*, 7218-22 (App. No. 34). Use of salicylic acid decreasing and of sulphites increasing, 7247-49.

68g 1. BUTTER:
- Not known, *Kellitt*, 50.
- Originally in butter collected from farmers in small quantities, *Hehner*, 5595.
- Unsalted, 1 lb. to 112 lbs. of saltless butter, *Sandes*, 79.
- Has revolutionised Irish butter trade, *Sandes*, 88.
- Have almost entirely replaced salt, *Sandes*, 80; *Dale*, 243.
- Generally insoluble and unworkable, *Shanahan*, 346-47.
- Dry form now in use, *Shanahan*, 350.
- Complaints obviated, *Hudson*, 551-52.
- Not used by Hudson Brothers, *Hudson*, 492, 546.
- Have conduced to growth of trade, *Lovell*, 709, 711.
- In nearly all butter, *Lovell*, 716.
- Not needed in well-made butter, *Riley*, 819, 836-37.
- None used by Aylesbury Dairy Company, *Boseley*, 975, 977-81, 1017, 1036-37; nor at Dunragit, *McCracken*, 2854.
- In from 50 to 60 per cent. of amount sold in London; and in all French produce, *Boseley*, 957, 973-74, 976, 1013-16.
- Distinct from that in milk and cream, *Voelcker*, 1692, 1748.
- Only salt necessary, *McFadyean*, 1756, 1758.
- Would not inhibit volatile agents, *McFadyean*, 1757.
- Physiologically indefensible, *McFadyean*, 1758.
- Not needed in butter carefully made and quickly consumed, *McCracken*, 2946.
- Necessary, *De Hailes*, 4003, 4016-19.
- None used by witness, *Carrington Smith*, 4454-56, 4473.
- Butter not in same case as milk, *quâ* use of preservatives, *Tubb-Thomas*, 4950-51. A difficulty arises in supplying large towns with fresh butter, 4952, at certain seasons, 4953, but Danish butter largely imported, 4954-55, without difficulty. Australian butters are preservatised, 4956. Many home creameries use preservatives, 4957. None known which do not, 4958. Witness would modify his view if he knew that large creameries did not use them, 4959-60.
- Butter not on same footing as milk *quâ* preservatives, *Carrington Smith*, 4558-60; *Corfield*, 5136-37.
- Butter churned by Aylesbury Dairy Company contains no preservative, *Hattersley*, 5796-97. Imported French butter contains a preservative, 5797. It is a factory butter, 5798-99. Preservatives seem necessary to Normandy saltless butter, 5800-1, 5835, system at fault, 5836.
- Preservatives should not be requisite for butter from field-drawn milk, *Lough*, 6629.

68g 2. BUTTER: Admixture:
- Very intimate, *Sandes*, 95, 96.
- Exclusive use of Normandy system not known of, *Dale*, 268.
- Before salt, after expression of butter-milk, *Shanahan*, 352-56.
- By whom, unknown, save as by dairy-farmer in one instance, *Williams*, 2115.

68g 3. BUTTER, Australasian:
- Australian butter not preservatised, *Hill*, 2475-77.
- Up to 1899 Australian butters found to be invariably preservatised, *Richmond*, 5692-93; when two good saleable butters were found free, 5694-96, 5736-37, 5740, but with salt, 5738, some 2 or 3 per cent., 5739, and no absolute necessity for preservatives inferred therefrom, 5697. Quantity in such butters reduced of late, 5698, from 1 to ½ per cent., 5699, without known change of mode of transit 5700-1

68. PRESERVATIVES, USE OF—*continued.*

68g 3. Butter, Australasian—*continued.*
  Preservatives added to New Zealand butter to aid keeping after defrosting, *Cameron*, 6171; but not universal, 6172, on account of recent action over here. Finest butter is preservatised slightly, 6173. Preservative very exactly blended with butter, 6184. Not likely to be added to milk by farmers because unnecessary, 6186-96. Preservatives facilitate New Zealand butter trade, 6203, essential to keeping the butter in the finest condition, 6204, but the trade not absolutely dependent on their use, 6205, though without them quality and price would decline, 6206. One-half per cent. of preservatives for butter quite enough, 6234-40, and satisfaction would be felt at any limit laid down, 6241-42. New Zealand Government have legislated as to preservatives, reserving the right to prohibit them if need be, 6246.
  Experiments made by New Zealand Government to determine results of adding preservatives to butter, *Cameron*, 6174; and ½ per cent. of preservative found beneficial for keeping butter, 3 per cent. of salt being also added, 6175-81, 6274, and preservative being boracic acid and borax, 6182, for ease of application, 6183, in powdered form, 6184. Evidence in a report of Mr. Sorensen when Chief Commissioner of New Zealand, Department of Agriculture, against use of preservatives in butter, 6252-69. Only one churning used for the experiment, 6270-73. Further experiments have been made, 6275-78, 6308-9. Conditions of uncleanliness obtain still in New Zealand dairy farms, but these not held to vitiate the results of the above experiment, 6279-89.
  Preservatives first used experimentally in a few tons of New Zealand butter, *Sorensen*, 6995, commercially nothing was gained by using them, 6996, but one or two boxes were reported to be very fine, 6997-98. Use given up, as expensive, 6999, and London agents quite satisfied, 7001. Opinion was divided in New Zealand a few years back as to preservatives, 7001. Of circularised factories, 60 per cent. deemed them to be unnecessary or useless, and only 20 per cent. were in favour of their moderate use, 7002. Some of latter, largest exporters in the colony, 7003, and advocated only ¼ per cent., 7004; ¼ to ½ at the very outside, 7005. At the time witness left the colony, ⅔rds of butter reaching England was not preservatised, 7006-7. Present condition of affairs not known, 7008, 7129, but reason to think increase of use since leaving, 7009. No doubt some pressure has been exerted, 7010-12.
  Experiments made with preservatives, as chief dairy expert for New Zealand Government, *Sorensen*, 7013, shewing slightly greater keeping power of chemically treated butter, 7014, the flavour being better preserved, 7015, ½ per cent. being the amount admixed, larger quantity flavouring the butter, 7016, giving it a saline taste, 7017. Experiments left witness unconvinced as to desirability of preservatives, 7018-21.

68g 4. Butter : Brittany :
  Requisite unless used rapidly, *Trengrouse*, 634.

68g 5. Butter : Canadian :
  Sent without preservatives, *Riley*, 819, 839.
  Boracic acid advised but not universally used, *Clement*, 1506-7, 1552-53.

68g 6. Butter : Character :
  Never analysed, *Sandes*, 83. Only one kind used, 100-101. Boracic acid, 102.

68g 7. Butter : Colonial :
  Average quantity ½ per cent., *Clement*, 1536.

68g 8. Butter : Complaints :
  Unknown, *Sandes*, 87.
  None known of, *Dale*, 255.

68. PRESERVATIVES, USE OF—*continued.*

68g 9. Butter : Consumption :
  Used for years, *Hudson*, 500.

68g 10. Butter : Danish :
  Not aware of, *Kellitt*, 45, 49.
  Used, or butter would not keep, *Sandes*, 117-19, *Lovell*, 717, 771.
  Winked at, *Sandes*, 117-19.
  Not advocated by Danish instructors, *Sandes*, 120.
  Prohibited, *Dale*, 247, *Shanahan*, 357-59.
  In England not known, *Dale*, 316-17.
  Prohibition has not affected trade, *Shanahan*, 357-59.
  Believed not to contain any, *Trengrouse*, 630, 654, *Boseley*, 1031, 1034-35.
  Obviated by short voyage, *Trengrouse*, 682.
  Only salt used, *Trengrouse*, 686-87.
  Not requisite, *Trengrouse*, 688.
  Not always used, *Lovell*, 718.
  One-half per cent. wherever possible, *Lovell*, 752-53.
  Claims not to use, *Clement*, 1514.
  Accepted as containing none, *Davidson*, 1594.
  Believed to be used, *Davidson*, 1595-96.
  Butter unpreservatised, *Bannister*, 3535.
  Butter unpreservatised now as a matter of protection against Irish competition. Boracised until recently, *De Hailes*, 3986-99.
  Preservatives not used in Danish butter, that is, in one-half of total foreign butter trade of England, *Faber*, 4317.
  Butter in Denmark preservatised to a small extent only, prior to prohibition of preservatives, *Faber*, 4219-20, and then only by boron base preservative, 4263-65. Most butter is salted to some extent, 4221. Some sent not salted, some ¼ per cent., but most about 1 per cent., 4222. Pasteurised butter adjudged the best, 4309-11.
  Free from preservatives, and practically also from salt, *Hehner*, 5600-1.

68g 11. Butter : Detection :
  One per cent. detectable, *Hudson*, 497-98, 500.

68g 12. Butter : Irish :
  Not always used, *Dale*, 274.
  Not needed if consumption were rapid, *Trengrouse*, 690-91.
  Enable butter made on old methods to be successfully marketed, *Lovell*, 747.
  Extensively used, *Riley*, 820.
  Seldom used in butter sent to Cork, *Dunn*, 3013, 3014.
  Used in factory butter, *Dunn*, 3013, 3015.
  Generally soluble borate of soda, *Dunn*, 3013, 3051.
  Quantity advised to traders is 1 lb. per 112 lbs. of butter, *Dunn*, 3014.
  Nothing in quality to necessitate, *Dunn*, 3023.
  Frequently mixed with salt first, 1 lb. to 100 lbs. of butter, *Dunn*, 3051-53.
  Irish fresh butter trade depends entirely on preservatives, *Gibson*, 6312-13, and these necessary for Irish salt butter also, 6314. All butter controlled by witness is preservatised, 6328, 6373. Trade will require preservatives until defects in present system are righted and butter is no longer required to keep as now, 6361, 6385, 6390-92, 6395-96. No complaints of preservatised butter, 6374-75, but complaints of unpreservatised butter, 6376.
  Preservative in Irish saltless butter, 1 lb. to 112 lbs., *Gibson*, 6328, 6377, analysing out to 0·8 per cent., and quite sufficient, 6329, 6378, 6400; 3 lbs. of salt added makes a salt butter, 6330. Use of preservatives in butter a question of rapidity of consumption, 6350. Consignees of witness know of preservative in butter, and private clients demand it, 6351. Borax and boracic acid the base of all the preservatives used, 6357. Preservatives will remain requisite till present defects of manufacture and the necessity for storage are removed, 6394-99.
  Conditions of housing of cattle in Ireland more favourable to prohibition of preservatives than in Denmark, *Lough*, 6656-58.

68. PRESERVATIVES, USE OF—*continued.*

68g 13. Butter: French :
  In all, *Boseley*, 957, 973-74, 976, 1013-16.

68g 14. Butter : Normandy :
  On soaked wrappers, *Dale*, 266.
  Wrappers and added preservatives, *Dale*, 267.
  One-half per cent. used, *Lovell*, 762-63.
  Salt or preservative used, *Bannister*, 3544-45

68h. Cider.
  American, of low alcoholic strength, and bad keeping quality, contains salicylic acid ; some also glycerine, *Voelcker*, 1655-58.
  Ten grains of salicylic acid per bottle harmless, *Bond*, 3117.
  Salicylic acid may be used ; it requires a preservative, *Bannister*, 3665.
  Cider and perry need no preservative ; none used by witness, but sulphur burned in vessels, *Radcliffe-Cooke*, 6576, 6604 ; and vessels kept clean, 6605-6 ; and skim milk used for thickening purposes, 6576. Sulphur fumigation destroys germs and slightly retards fermentation, 6577, 6609-10. Many makers use preservatives, 6578 ; nearly all being preparations of borax or salicylic acid, 6579 ; which are put in at any stage of manufacture to stop fermentation ; sugar of boron being one kind, used also in mineral waters and non-alcoholic beverages, 6580. Sugar of boron used also in brewing. "Cynin" also used in cider ; it consists of a solution of salicylic acid and borax in glycerine ; experiment showed it an excellent preservative, 6581 ; but the cider kept by its use was not matured, and the control unpreservatised cider had been lying about unheeded. Another cider preservative, "Walter Gregory's powder," consists of salicylic acid and a small quantity of red oxide of iron, 6582. Formalin seldom used in cider. "K.M.S." not analysed. Anti-ferments are used to make bad cider good. "Hawkes' Anti-ferment" of a different class. Formalin used for brewing and mineral waters. "Hawkes' Cider Restorer" used for decomposed, ropy and unhealthy cider, 6585. Cider not often fortified, 6587-88. Preservative advertisements known of are from Somerset and Devon, 6589 ; handed in, 6603. Nothing known of the use of preservatives in French cider, 6591-92. Preservatives are substitutes for cleanliness, and induce carelessness, 6593. Public probably know of their use, 6594. Certain firms advertise no chemicals as used, 6595, 6599-6601, and then use them, 6596-97. Declaration of preservatives should be made by label on the bottles or vessels, 6598-99. No objection to sulphur sterilisation of vessels, 6606. Would not use boracic acid or formalin, 6607 ; they stop fermentation, cider never reaches maturity, and they are harmful, 6608. If preservatives permitted no reason why present non-users should use them, 6611-12 ; and prohibition would affect only the dishonest trader, 6613.
  Preservatives in cider used by best makers in small quantity, *Symons*, 7264-65. Salicylic acid, saccharin, sulphite of lime or soda used, 7266 ; the saccharin being soluble, 7267 ; a product of coal tar, 7268-69 ; identical with "Tigress Brand" of saccharin, 7270-72. Preservatives good in small quantity to arrest viscous fermentation, 7273-77. Has used preservatives hitherto under certain conditions, 7278-80. They should not be prohibited but limited, 7281 ; as to quantity, 7282-84. Salicylic acid not always used, and only a small quantity at any time ; a standard should be fixed, 7285 ; not more than ½ to 1 oz. of salicylic acid per 116 gallons, 7286-87 ; and ⅛ to ¼ oz. of saccharin 7288. Beer showing incipient taint would be beyond the aid of saccharin, 7289 ; as also would cider. Preservatives should be used from one to three months before public get the cider. Salicylic acid held in Court to do more good than harm as used in cider, 7290. Only best makers should be allowed to use it, 7291-92. Too much preservative might be harmful, 7305. From 1 to 2 oz. of soda would be used per pipe, 7306. About ⅓ more used in America, 7307-9, and in Germany saccharin and salicylic acid used largely, 7310, about ⅓ more than above suggested standards, 7311. Has never used as much as Germans or Americans, 7312. A witness holding that preservatives are not needed in cider, not one having a great experience, 7293. Pure cultures can be obtained for been manufacture, 7294-99. Has isolated pure yeast from apple pulp, 7300, and has identified the organisms concerned in cider manufacture, 7301. There are many kinds of germs, yielding differing results. A constant germ might obviate need for preservatives in cider, 7302-4. Cleanliness no substitute for preservatives, 7313. Difficult to exclude such bacilli in cider-making as to obviate use of preservatives, with a weak percentage of spirit, 7314-17. Sick cider would not be salicylised, 7318, but with indications of going wrong the acid would be added as a preservative, 7319-23. Such indications are exceptional, 7326. Pasteurising does not work well, 7324. It causes insipidity. It is practised in France and Germany, 7325. Too late to pasteurise cider quite ready for consumption. Preservatives in cider not universally advocated, but honest traders should be permitted to use a small quantity in case of necessity, 7327, 7335. Cider industry very ancient, 7328, but progressive, 7329-30. Perfection of keeping cider probably attained, 7331, and knowledge has followed experience, 7332, by the aid of bacteriology, 7333, 7335. Difficult to say if manufacture of cider has improved, 7334.

68j 1. Cream :
  Not known to be used, *Dale*, 338.
  Necessary to keep cream a day in summer, *Hudson*, 515.
  In jugs issued by Aylesbury Dairy Co. used to be preservatised ; practice stopped, *Boseley*, 981, 1017, 1036, *Richmond*, 5667-72, *Hattersley*, 5789, 5791.
  None used in Aylesbury Dairy Co.'s clotted cream, *Boseley*, 982-83.
  Needed if clotted cream is to keep more than two days in summer, *Boseley*, 984.
  Needed for small vendors but not by large companies, *Boseley*, 1039.
  Powdered borax applied, and not always intimately mixed, thus tending to vitiate analyses, *Walford*, 1901-6.
  Boracic acid largely used, *Handford*, 2278-80.
  Boracic acid and salicylic acid found, *Hill*, 2362-64, 2385 ; from 24 to 42 grains of boracic acid per lb., *Hill*, 2367.
  If found at top of jars substance not properly treated, *Bell*, 2829.
  Not needed in, *Bell*, 2830, 2837, 2839 ; *Cassal*, 3804, 3819.
  Admixed in a little milk, and well stirred in, *McCracken*, 2864, 2868.
  All preservatised at Dunragit, *McCracken*, 2853, 2865-67.
  Would not keep well without them, *McCracken*, 2869.
  Boracic acid found from 0·104 to 0·291 per cent. of boron-trioxide, *Cassal*, 3815.
  Medical men hold preservatives in cream to be dangerous, *Cassal*, 3820.
  Trade would cease if preservatives were prohibited, *De Hailes*, 3984, 4033.
  All London potted cream preservatised, *De Hailes*, 3985.
  Cream samples found to contain boracic acid as a borate, 17 to 38 grains per pint *W. C. Williams*, 5164-65, both potted and bottled, 5166. One sample unfit for use, 5167-68, and deemed to be injurious to health, 5325. Potted samples from grocers, 5221, who require the preservative to keep the cream, 5122-26, more than the dairyman, 5127-31.

68. PRESERVATIVES, USE OF—*continued.*

68j 1. CREAM—*continued.*

Nearly always boric compounds, *Hehner*, 5584.

Cream as sold by milkmen rarely preservatised, *Hehner*, 5576, 5581. Cream from grocers almost always preservatised, 5582-83, always boric compounds, in many cases 56 grains per lb., 5584. Grocers' trade in cream calls for preservatives, 5585-88, and induces them to use them, 5589-91, and mislead the public as to keeping quality of cream, 5592.

Cream preservatised by formalin, borax, boracic acid, and saccharated lime (called "viscogen") which retards curdling and evidence of sourness and is an alkali, *Richmond*, 5659-64, "Special Cream Compound" used, a borax-boracic acid-saccharin mixture, 5664-66. Aylesbury Dairy Co. used to use 0·2 per cent. of boracic acid in cream, 5667, not now, 5668, it was objected to and found to be unnecessary, 5669. No preservative used now at all, 5670-72.

Cream collected by Aylesbury Dairy Co. in London except one supply from Sussex, *Hattersley*, 5787-88. No preservative used, 5789, even in clotted cream, 5791, also made in London, 5792. Only one verbal and one letter of complaint of cream per 2,000 and 20,000 quarts respectively, 5790, and less frequent relatively than as to milk, 5872-78. No preservative required for Devonshire clotted cream sent to London, 5793. Clotted cream keeps longer than ordinary cream, 5794-95. Grocers sell cream because they can preservatise it, 5854-56.

Cream has been sold without any preservative, *Lough*, 6688-89.

Cream not much used in children's hospitals, *Still*, 6803. Used chiefly for marasmus, 6,804. Same objections apply as to preservatives as in the case of milk, 6805.

Cream more commonly preservatised than milk, *Hope*, 6834, and sold both by dairymen and grocers, 6836. Preservatives not necessary, 6835, and not approved by medical authorities, 6837.

Cream needs no preservatives if traded by proper channels, *Sorensen*, 7116-17, daily, 7119-20. The grocery trade has made them requisite, 7118. None used in Copenhagen, 7120, with extremes of temperature, 7121-22, and cream travelling three to five hours, 7123-24. From 140 to 150 grains of boracic acid found per gallon of cream taken haphazard in Manchester, 7141-45.

68j 2. CREAM: Admixture:

Often all at top of jar, *Voelcker*, 1642.

68k. CREAMERIES:

Long used at Dunragit, *McCracken*, 2852.

Butter demands a preservative, *Bannister*, 3536-37; without preservative it goes off quickly; much used, 3538-39; not necessary in butter for quick consumption, 3540; necessity not universal, even in creamery butter, 3541-43.

Nearly all the Irish creameries use preservatives in summer, 6621. Only butter made *Lough*, 6622. Preservatives not essential to creamery industry. They are asked for, but less quantity than used would suffice. No complaints made of use of preservatives, 6625. Use of preservatives deprecated in agricultural products, 6659. They would be quite unnecessary in a few years in creameries with proper organisation, 6660. Presumably preservatives in butter would be harmful, 6668. They should be done away with, and are being got rid of in witness's creameries, 6676. Borax chiefly used, 6681.

68l. DAIRY PRODUCTS:

Milk, cream, butter, and condensed milk most frequently treated with borax, boracic acid, and formalin; very occasionally with salicylic acid, nitrates, and sulphites, *Boseley*, 951–52.

Not needed, *Long*, 4571, 4577–78.

68. PRESERVATIVES, USE OF—*continued.*

68l. DAIRY PRODUCTS—*continued.*

Used promiscuously, 56 grains per gallon known, and 1-20th oz. per gallon, *Long*, 4579-81.

Use opposed by the Central Chamber of Agriculture, by formal resolution, *Carrington Smith*, 4410-11, 4487. Preservatives advertised at Islington dairy show, 4540-44. List of preservatives handed in, 4544-47, (App. No. 11). Preservatives held to be seldom used by farmers, but often by dealers, 4549.

Unnecessary and undesirable, and a cloak for dirt, *Kaye*, 5448-51, 5519-20.

Not used by Aylesbury Dairy Company, save in some imported butter sold by them, *Richmond*, 5641-42.

Commonly used, *Fisher*, 4717.

68m. FRUITS, BOTTLED:

Not used by Messrs. Keiller, *Boseley*, 1062.

68n. GROCERY TRADE:

Salt, saltpetre, sugar, oil, vinegar, and glucose mostly used, *Copeman*, 1169-70.

68o. HAMS:

Dusting by, and packing in, alone known, *Kellitt*, 26.

One lb. needed per cwt., *Gregson*, 924.

None detected on Danish hams, *Kellitt* 69-72.

68p. JAMS:

In some 50 per cent. of makes, *Boseley*, 968. None in fruit for jam, *Boseley*, 969-70 None by Messrs. Keiller, *Boseley*, 1143. Messrs. Keiller would like to use them, *Boseley*, 1144. Needed for large quantities of jam, as made, if required to be kept several months, unless it be cooked to stiffness, *Boseley*, 1084-85.

Sugar used, *Copeman*, 1231.

Preservatives not known to be used in preserved fruits and jams; not used by Crosse and Blackwell, *Blackwell*, 4863-64, 4871, 4875, and quite unnecessary, 4865, 4872, 4918-19. None used in jam pulp, 4866-67. Jam from imported pulp only as regards apricot made by Crosse and Blackwell, 4905-7, and believed to be free from preservative, 4908-9, which would flavour the pulp, 4910-13. No preservative needed in any pulp, 4914-17. Preservatives do not cheapen jam, 4920-22.

Jam found to contain salicylic acid from ¼ to 4½ grains per lb., *W. C. Williams*, 5180. Bottled fruits and some jams found free from preservatives, which seem not to be needed in large, clean fruits, 5181, as opposed to small and easily damaged fruit, 5182. No proceedings taken, 5183. Difficulty apart from preservatives thought of as to small fruit jams, 5184, but not upheld if makers do really get on without them; 4½ grains per lb. in any case too much, 5185. Use not decreasing, 5264-67. Quality of fruit a prime factor, *quâ* preservatives, 5268-71. With proper care all round salicylic acid not requisite, 5272, and used, where used, often without thought, 5273, and its prohibition would not injure legitimate trade, 5274. One unpreservatised sample of jam contained mould spores, 5326-30. Imported pulps seldom preservatised; preservative unnecessary, 5331-35.

68q. MARGARINE:

Borax and boracic acid used, *Lovell*, 806; sometimes in summer only, *Clement*, 1522-25.

In Birmingham 84 per cent. of samples contained boracic acid, *Hill*, 2349-50, 2385, 2388.

Used at Dunragit, *McCracken*, 2853. Necessary in trade of to-day, *McCracken*, 2857. Dutch method of milkless and unpreservatised manufacture not known, *McCracken* 2891-93. Quantity needed about ½ per cent., *McCracken*, 2929-30.

PRESERVATIVES, USE OF—*continued.*

68q. MARGARINE—*continued.*
- Margarine samples nearly all contained borax or boracic acid, *W. C. Williams*, 5172, 5251-54. Mostly sold as butter, 5173-74, and much used in cooking; usually some 20 grains per lb., 5175. Service of boracic acid or its necessity doubted, 5255-61, 5263, but trade seem to regard it as necessary, 5262.
- No necessity, *Hehner*, 5599, 5603-4.

68r. MEAT FOOD:
- In Birmingham in 64 per cent. of samples examined boracic acid from 10 to 45 grains per lb. found, *Hill*, 2352-53, 2385, 2410-14; acid generally intimately distributed, 2357-60; taste would reveal its presence, 2361.
- In imported American meat, *Boyce*, 2743.
- Found in meat and tripe, *Kaye*, 5444.
- Cow carcases known to be dredged all over, *Kaye*, 5462.

68s 1. MILK:
- Perhaps in 50 per cent. of London milk supplies, *Boseley*, 956.
- None by Aylesbury Dairy Company, *Boseley*, 1017, 1019.
- Boracic acid most general, *Voelcker*, 1639, 1643. Salicylic acid formerly used; not now found, *Voelcker*, 1643. Boracic acid and formalin most commonly used, *Stevenson*, 4804.
- Formalin and boron base preservatives mostly used, *De Hailes*, 3930-31.
- Formalin never yet found, *Voelcker*, 1643.
- A serious question, *Walford*, 1927.
- Should be allowed guardedly in summer, *Vasey*, 2047-51.
- In 9 per cent. of samples examined in Birmingham, from 1896 to 1899, boracic acid and formaldehyde being in question, *Hill*, 2332, 2385, 2461-63.
- In 2 per cent. of samples from farmers, *Hill*, 2341.
- Most frequent in summer, *Hill*, 2343, 2389-93.
- Same sample contained boracic acid and formic aldehyde, *Hill*, 2381-82.
- Old milks naturally would be preservatised, *Hill*, 2401-8.
- Lower classes most likely to get such milk, *Hill*, 2450.
- Disapproved of by Society of Medical Officers of Health, *Hill*, 2522.
- Should be effected soon after milk drawn, *Annett*, 2681.
- At time of milking, *Rideal*, 3697; *Foulerton*, 4050-57.
- No known difficulty in way of adding at time of milking. It is done by some, and might be done by all, *Rideal*, 3700.
- Habitual by some farmers and dealers in Hants in summer, *Brierley*, 3188, 3236-38.
- Often present though not found, *Robinson*, 3307.
- Dover milk largely free from, and Broadstairs milk said to be preservatised, *Robinson*, 3308-9.
- Not approved, *Blyth*, 3447.
- May be partial, and still indiscriminate, *Bannister*, 3631-33.
- Should not be permitted for relief of small vendor, an undesirable milk seller, *Cassal*, 3805.
- Substances chiefly used are drugs, boracic acid, borax mixtures, or solutions, salicylic acid, formaldehyde; in some cases benzoic acid, probably as benzoate of soda, and borofluoride. All are foreign ingredients, and are liable to be added in needless quantity, *Cassal*, 3812.
- Distance a factor, *De Hailes*, 3926-27, 3948-49, 4004-9.
- Largely used in London, and present trade demands preservative, *De Hailes*, 3923-25, 3928-29.
- Lesser of two evils, *De Hailes*, 4031.
- Should not be preservatised, *W. C. Williams*, 5220.
- Largely used in summer, but not in winter, *Kaye*, 5444-46.

68. PRESERVATIVES, USE OF—*continued.*

68s 1. MILK—*continued.*
- Samples largely free, though both formalin and borates found, as regards country milk, *Hehner*, 5576-79.
- Better than sour milk, *Hutchison*, 6720-21, or bad food, 6749-50, especially milk, 6751-52.

68s 2. MILK: Admixture:
- Quantity may vary in different samples, *Voelcker*, 1640-41, 1671
- May be repeatedly added, haphazard, *Voelcker*, 1672-75.
- By whom unknown, save as by dairy-farmer in one instance, *Williams*, 2115.
- No precise method, *Williams*, 2119.
- May be repeated, *Williams*, 2120.
- Preservative added to a little milk, then intimately mixed with bulk, *McCracken*, 2862-63.
- Not used by farmers supplying Dunragit creameries, *McCracken*, 2877-79, 2925-27
- Systematic, at Dunragit creameries, as each can is ready to go out, *McCracken*, 2937.
- Repeated oft-times, *Brierley*, 3183-87.
- Should not be left to consumer, *Rideal*, 3777.
- Should be used immediately after milking, *Annett*, 2681; *Foulerton*, 4050-57; at time of milking, *Rideal*, 3697 3700.
- Nothing to prevent consumers adding preservatives to milk, but practice not known, and to be deprecated, *Foulerton*, 4174-81.
- Repeatedly made, though this denied, *Long*, 4604-12.

68s. 3. MILK: Adulteration:
- Common in preservatised milk, *Voelcker*, 1652.

68s. 4. MILK: Complaints:
- None made to Dunragit Creameries, *Mc Cracken*, 2880.

68s. 5. MILK: Condensed:
- Australian sample contained half per cent. of boracic acid, *Voelcker*, 1645-51, 1677-81.
- Not requisite, *Voelcker*, 1651.
- Found to contain boric compounds, *Cameron*, 2528.

68s. 6. MILK: Creamery Milk:
- None used prior to reaching creamery, *Sanders*, 124.

68s. 7. MILK: Dangerous:
- Unnecessarily so, *Jones*, 1309, 1362, 1365.
- Milk of bad-keeping quality enabled to be sold as good milk, *Voelcker*, 1715.
- Might be distinctly so, if amount useful *Fadyean*, 1752.

68s. 8. MILK: Objectionable:
- On ground of injury to health, but no case of injury known as regards preservatised dairy produce, *Carrington Smith*, 4553, 4561-64.
- Not known to witness that preservatised milk cannot be used for butter-scotch, *W. C. Williams*, 5243-45, 5248-50.

68t. PERRY:
- Needs no preservative, *Radcliffe-Cooke*, 6576, 6604.

68v. PORT:
- Boric compound found, *Cameron*, 2528.

68w. SHERRY:
- One sample salicylised, *Hill*, 2364; *Brierley*, 3191-96.

68x. TEMPERANCE DRINKS:
- Not by Crosse and Blackwell in lemon squash or lime juice, *Blackwell*, 4884-85. They would be convenient in the latter to prevent moulding, 4886, and are no doubt largely used, 4887-88.
- Temperance drinks found to contain much salicylic acid, *W. C. Williams*, 5186. Lime juice cordial found to contain from 20 to 108 grains per gallon; none is needed, 5187. The acid stops fermentation, 5188. Salicylic acid and formalin, and salicylic acid and boracic acid found in samples, 5189. Unsweetened lime juice, but no sweetened lime juice cordial found unpre-

68. PRESERVATIVES, USE OF—*continued.*

68x. TEMPERANCE DRINKS—*continued.*
servatised. In lemon squash 50, in ginger wine 118, in raspberry wine 133, in orange wine 106, and in black currant wine 140 grains of salicylic acid per gallon, 5190-92, and the acid found in herbal ale, 5277, all really non-alcoholic wines, 5193, 5285-88. Proceedings failed in cases where taken in Liverpool, 5193, because of medical evidence in favour of use of the preservative, 5194-95, and of evidence of manufacturers as to fruit used, but amounts recorded are above all requirements, 5195. Children principal consumers of above beverages, 5278-80, who might thus get large quantities of salicylic acid, 5281-84, 5308-11.

68y. VINEGAR:
Boracic acid found in Birmingham, *Hill*, 2362-64, 2385. In malt vinegar 14 grains of boracic acid found per gallon, 2367.

68z 1. SALICYLIC ACID: Beverages:
Excluded by reason of hurt to trade by its known inclusion, *Vasey*, 1986.
Found in temperance drinks, to arrest fermentation, *Blyth*, 3460.
May be used in cider, *Bannister*, 3665.
Used in wines, and liquids of weak alcoholic strength, desired to be clear, *Bannister*, 3558.
Proceedings taken for use in lager beer and orange wine, *Bannister*, 3559.
Found in wines, in port wine in varying quantities, up to 3·15 grains per gallon, *Cassal*, 3822. It is a foreign ingredient, 3823-24. In sherry, 1·6 grain per gallon found. Large amounts found in so called British wines, 3824. An amount like 0·7 grain would have little preservative effect on port; would probably be present as the result of blending, 3825. Cheaper wines most preservatised. Has found 26·6 grains per gallon in orange wine, 11·55 grains in British sherry, 4 grains in black currant wine. Prosecution, that failed, in case of orange wine, 3826. Found in beer occasionally; 7 grains per gallon in bottled beer, 4·76 grains in Pilsener beer, 3827. Not many samples of beer examined, 3828. In lime juice 70 grains per gallon found, 3829. Some lime juice found free from it, 3830, and unnecessity hence inferred, 3831.
Found chiefly in lighter kinds of wine, including British wines, with some prosecutions, and in light beers, *Corfield*, 5072.
Found, 150 grains to a gallon of wine, *Hope*, 6923: some 19 grains per pint, 6924. This would, with other such things, upset children, 6925, but is not a serious matter of itself, 6927-28. British wines in question, 6926.
British wine found to contain 150 grains, *Hope*, 6842, 6923.
(*See also* under Beer.)

SALICYLIC ACID: Food: Use:
Not increasing, *Vasey*, 2042.
Never found in butter. *Hill*, 2351.
Poisoning by use not known, *Hill* 2416-17.
Indiscriminate, not advocated *Bond*, 3112.
Found in a variety of articles, *Cassal*, 3816.
Objection to indiscriminate use, *Stevenson*, 4824-25.
Studied, *Corfield*, 5071.
Common, *Still*, 6808.

68z 3. SALICYLIC ACID: Jam:
Chief preservative, *Boseley*, 968; amount, ½ oz. to one cwt., or $\frac{1}{3500}$, *Boseley*, 968; 5 milligrammes to 1 lb. of jam, *Boseley*, 1089-91; boiled with jam, and intimately mixed, *Boseley*, 1087-88, 1092; used, of necessity, in pulps, *Boseley*, 1092; salicylised jam does not go bad, *Boseley*, 1093-95; jam-makers' preservative; a good anti-fermentative, *Boseley*, 986-88.
In strawberry jam, 3½ grains per lb., *Voelcker*, 1661; presence objectionable, *Voelcker*, 1662-63 1670; covers imperfections, *Voelcker*, 1664, 1706; not necessary in well made jam or fruit pulp, *Voelcker*, 1664, 1704, 1706.
Found in Birmingham, *Hill*, 2362-64, 2385.
Two grains per lb. harmless, but efficient, *Bond*, 3113-15.
Jam unequally preservatised with salicylic acid; some has none, and some ten times that of others containing the acid, *Hope*, 6843. None necessary, 6844. Manufacturers probably ignorantly reckless, 6845.

68z 4. SALICYLIC ACID: Wine:
Ten grains of salicylic acid per pint harmless, *Bond*, 3116.
Preservatives not necessary, and used only since 1875, *Brierley*, 3259-61.
Benzoic acid found, *Cassal*, 3816.
Preservatives, other than brandy, unnecessary in wines imported to this country, *Gilbey*, 4361, 4371, 4380. Salicylic acid heard of years ago in cheap Spanish wine, 4362 Tarragona, 4369; and known in wine producing countries, 4363; really in inferior wines, 4364. It is a preservative, and reduces the amount of spirit required, 4365; arrests fermentation, and is easily detectable, 4366-71. Not known in this country, 4366-67, 4371-75, 4379, 4392, 4404. Light Portuguese wines not likely to be imported, unless fortified or preservatised, 4376; and not known to be imported, 4377-78. "St. Julien," made on banks of Thames, extremely likely to contain salicylic acid, 4381-86. Mineral acids in wine not known, 4405-6.

69. PRICE:

69a. BACON:
Price of Canadian bacon the inducement to buy it, but English curing of bacon greatly on the increase, *Harris*, 5981-85. American bacon goes mostly to poorer districts, 6018. Price of bacon, if borax prohibited, would only be affected as mode of carriage increased in cost, 6028-33. If America and Canada charged English prices they would sell no bacon, 6034.

69b. BUTTER:
If better, dairying would grow, *McFadyean*, 1774.

69c. BUTTER: Australasian:
Price of New Zealand butter cheaper than Danish butter, *Cameron*, 6168, and butter coming over unpreservatised sold cheap than preservatised butter, 6207-10.

69d. BUTTER: Brittany:
Commands highest price, *Trengrouse*, 698.

69e. BUTTER: Danish:
Lessened if kept over a week, *Shanahan*, 379-80.
Relatively high, *Trengrouse*, 697.
Commands good, *Riley*, 843-44; *Hehner*, 5602.
Best, *Clement*, 1513.
Unpreservatised, fetches a higher price than preservatised French butter, *Long*, 4629-42, 4672-76.

69f. BUTTER: Irish:
Commands good price, some butter bein preservatised, *Gibson*, 6354-55.
Price of Irish winter butter higher than best Danish, *Gibson*, 6326, 6404; some of the former being salted, and some saltless, 6327.

69g. MILK:
Would not be raised by prohibition of boracised preservatisation, *McFadyean*, 1773.
If better, dairying would grow, *McFadyean*, 1774.
Of skim-milk, would not allow of sterilisation, *McCracken*, 2908.
Cheapness may mean milk and water, *Brierley*, 3264.

69. PRICE—*continued.*

69h. Preservatives : Butter :
Not affected, *Sandes*, 90-94.
Regulated by use, enabling butter to keep till needed, *Shanahan*, 395-97.
Determines time butter is kept, *Shanahan*, 398.
Does not affect the use of preservatives, *Shanahan*, 405-12.

70. PROCEEDINGS :

70a. Boracic Acid :
Cream boracised 16 grains to ½ lb., or ¼ per cent., *Hudson*, 509-13.
In milk and butter, especially, subject of action by Glamorgan County Council, *Williams*, 2111, 2188, 2190.
May have stopped use of boracic preservatives, *Williams*, 2138, 2144-45, 2221-23.

70b. Boracic Acid : Butter.
Would probably be taken for 1·3 per cent. as at Pontypool, *Jones*, 1311, 1320. Bench held 1·3 per cent. to be injurious to health, *Jones*, 1321.
Taken for 71·4 grains per lb., *Walford*, 1842-45.
Taken successfully in Birmingham, *Hill*, 2367-68.

70c. Boracic Acid : Milk :
Successful in County Glamorgan, *Williams*, 2130-34 ; and in Birmingham, *Hill*, 2341.

70d. Borax : Butter :
None known on account of excessive weight, *Bennett*, 221-26.

70e. Borax : Ham :
Evidence given *re* boracised ham, *Prossor*, 571-72.
Taken for 56 grains per lb. at Pontypridd, *Williams*, 2226-28, 2234, 2237-38.

70f. Formalin : Dairy Products :
Successfully taken, *Boyce*, 2709-10.
Successfully taken in Liverpool for formalised milk, *W. C. Williams*, 5158, 5161 ; and unsuccessfully for salicylised temperance wine, 5158. Use of formalin was increasing, and was checked by the conviction obtained, 5159. Conviction secured because formalin an adulterant and deemed to be injurious to health, 5316-21. Injury not known, 5322-24. No considerable account of case published, 5428-31.

70g. Preservatives :
Difficult on ground of injury to health, *Hill*, 2024-32.
None taken in West Riding by reason of appointment of present Committee, *Kaye*, 5443, 5463.
Have elicited defence that preservatives as used are not a danger to health. Witness disagrees. Another defence has been their use as medicines ; but the argument is absurd and the administration of drugs in such manner is most objectionable, *Hope*, 6846.
Ending in convictions, have been taken in a number of instances, *Cassal*, 3795 ; but necessity of proving injury to health is a difficulty, 3796. Prejudice of customer not now found to be a difficulty as to proof, 3797-99. Expense of procedure is a difficulty with certain local authorities, 3800-1, Certain multiple forms of statement in regard of contained preservative held to be necessary to satisfy the Court, 3817.

70h. Preservatives : Butter :
Taken by Glamorgan County Council when 34 grains per lb., *Williams*, 2129. Convictions have followed proceedings by the Council, *Williams*, 2135-36.

70j. Preservatives : Milk :
Would be taken at Newport (Mon.) when found, save in case of formalin, *Jones*, 1405, 1408-11.
None instituted against Dunragit Creameries, *McCracken*, 2881.

70. PROCEEDINGS—*continued.*

70k. Preservatives : Cider :
Ground for such, if quantity large, *Voelcker*, 1659.

70l. Preservatives : Cream :
Fine inflicted in case when 0·464 per cent. crystallised boracic acid present, *Cas* 3852-54.

71 PROHIBITION :

71a. Benzoic Acid :
Needed, *Vasey*, 2046.

71b. Boracic Acid :
Was followed by reduced sale, and growing demand for other preservatives, *Jones*, 1392-94.
Preferred to declaration, *Cameron*, 2579.
In force in Austria, *De Hailes*, 4006, *Corfield*, 5098-5100.
Should not be allowed in multiple articles of diet, *Stevenson*, 4832-33.
Desirable, unless proved absolutely harmless, in all food, *Corfield*, 5083-84.

71c. Boracic Acid : Dairy Products :
Would curtail supply, *Williams*, 2148.
Absolute in France as to butter, if not also milk, save for export, *Williams*, 2218-20.
Interests of dairy farmers not prejudiced by action of Glamorgan County Counci *Williams*, 2221.

71d. Boracic Acid : Milk :
Recommended by Glamorgan County Council *Williams*, 2129.
Might in great measure be absolute if cleanliness assured and cold storage adopted, *Handford*, 2276, 2322.
Milk should not be boracised, *Handford*, 2302-4, 2319.
Should be absolute, *Mann*, 2606.
Not necessary, *Bell*, 2812, 2814, 2817.
In force at Guy's Hospital, *Stevenson*, 4798.
Of boracic acid in milk necessary ; milk most largely used by children and invalids, *Tubb-Thomas*, 4932, 4934.
Would object to use of boracic acid and borax, especially in milk, *Starling*, 6944. Would not tolerate them in milk, 6954.
Of boracic acid in milk urged on account of harmfulness to children and also adults in ill-health, *Anderson*, 7189.
Advocated by Mr. Lockwood, *Womack*, 7507.

71e. Borax : Bacon :
Would kill foreign competition, *Bennett*, 178.
Would result in attempt to cure bacon of poor keeping quality in Ireland, *Kellitt*, 32.
Would ruin Canadian, American, and Australian trade, *Bennett*, 156-60, 166-68; *Sinclair*, 936.
Would raise prices, *Bennett*, 163, 165
Would check even continental products, save for immediate use, *Bennett*, 169-70.
Would result in return to salted meat, or in cessation of trade, *Bennett*, 175.
Would curtail trade, *Gregson*, 875.
Restriction in use for packing would hamper transatlantic trade, unless cold chambers were used, *Long*, 4659-60.

71f. Borax : Competition :
Foreign would cease, *Bennett*, 178.

71g. Borax : Ham :
Serious in absence of equally good preservative, *Kellitt*, 30.

71h. Borax : Prices of :
Bacon would rise, *Bennett*, 163, 165.

71j. Borax and Boracic Acid : Butter :
Would result in return to salt, *Trengrouse*, 703.
Would seriously affect the trade, *Clement*, 1527-28.
A little might be allowed in butter, *Stevenson*, 4832-33.
In butter used in France, *Hehner*, 5619 22.
Advocated by Mr. Lockwood, *Womack*, 7507.

71. PROHIBITION—*continued.*

71k. Formaldehyde :
  Needed, *Vasey*, 2046 ; *Hehner*, 5611.
  Should be prohibited in milk, *De Hailes*, 3966-70.
  Formalin should be prohibited until more is known of it, *Fisher*, 4767-68.
  Of formalin as a preservative should be absolute, *Starling*, 6940; *Halliburton*, 7548, 7550.

71l. Preservatives :
  No general action in Birmingham, *Hill*, 2328-29.
  Preferred to declaration, *Boyce*, 2772.
  In Belgium and Germany, *Boyce*, 2741-42.
  Believed to exist in Austria, *Boyce*, 2745.
  Would seriously interfere with trade, especially dairy trade, and provision trade generally, *Bannister*, 3675-76.
  Substances of a poisonous character, or having active character as a drug should not be used in food, *Cassal*, 3794.
  Advocated, other than common salt, but including saltpetre in prohibition, *Cassal*, 3855-57.
  Of preservatives, or a "leave alone" policy the alternatives if limitation of maxima impracticable, *Foulerton*, 4153-54, and the former inclined to as regards chemical preservatives, 4155-56, that i total prohibition, 4157.
  Of preservatives in milk would not restrict supply, *Long*, 4572. Prohibition of preservatives should be enforced as regards substances the effect of which upon infants and invalids is not known, 4689. The effect should be determined prior to use, 4703-6.
  Of preservatives should be enforced in some cases, *Fisher*, 4727, and entirely in new milk, 4728, and new cream, fresh fish and fresh meats, 4745. No resolution passed by Society of Public Analysts, 4744.
  Advocated, *Stevenson*, 4832-33.
  Of preservatives not deemed essential if moderate quantities only used, *Blackwell*, 4873.
  Of saltpetre and pyroligneous acid desirable, *Corfield*, 5087.
  Salicylic acid, borax, boracic acid, and soda prohibited in Austria, *Corfield*, 5098-5100.
  Drugs should be avoided as preservatives in absence of knowledge as to action on the human economy, *Corfield*, 5121-22.
  Of preservatives or nothing advocated, for several reasons, including liability to repeated dosage, *Richmond*, 5754.
  Preservatives objected to on principle, *Dupré*, 5903, and indiscriminate admixtures of chemicals to food, 5904, irrespective of their effect, 5905.
  Preservatives should be prohibited, as injurious to cells of the system, *Grünbaum*, 6476, 6478 ; in other substances as well as milk ; and including sodium sulphite, and boracic acid. Aseptic rather than antiseptic food should be aimed at, 6477.
  Advocated in food, *Starling*, 6986.
  Of preservatives advocated unless declaration of nature and amount be made, *Poore*, 7339-40.
  Of all foreign substances as admixtures in food to be desired, *Halliburton*, 7530, 7573-77. May be difficult but is ideal, 7578. Prohibition of formaldehyde should be absolute, 7548, 7550, also of salicylic acid, a dangerous drug, 7551-53. Nitrate of potash should be prohibited, 7576.

71m. Preservatives : Bacon and Ham :
  Would affect producer and consumer, *Hudson*, 501
  Would injure Irish and foreign trade, *Hudson*, 504.
  Enforced by France against America and withdrawn in 1899, *Hudson*, 505, 523.

71n. Preservatives : Butter :
  Would affect keeping quality of Irish butter, *Dale*, 248

71. PROHIBITION—*continued.*

71n. Preservatives : Butter—*continued.*
  Would injure Irish trade, *Dale*, 256 ; *Shanahan*, 361-62, 412 ; *Hudson*, 538, and stop it, *Lovell*, 737, 765 ; *Riley*, 820.
  Would injure butter trade generally, *Lovell*, 764.
  In appreciable quantity at Newport (Mon.), *Jones*, 1309.
  Should be absolute, unless stringent rules as to quantities made, *Williams*, 2112, 2140.
  Desired, but deemed difficult, *Hehner*, 5609.
  Of preservatives would be a hardship on some butter makers for a long time, *Lough*, 6661, 6683-84. Harmful preservatives should not be used, 6664-67.
  Advocated by Mr. Lockwood, *Womack*, 7507.
  Would not permanently affect trade, *Dunn*, 3018-21.
  Home trade, some think, would be served thereby, *Dunn*, 3021.
  Dreaded by some, *Dunn*, 3022.
  Prices would not be long or greatly altered, *Dunn*, 3050, 3056.
  If enforced, Australian and Canadian butter would have to come frozen or in cold store, *Dunn*, 3057-58.
  Would lead to cold storage and frequent local demands as essentials in Ireland, *Dunn*, 3059.
  Medical considerations should outweigh those of trade, *Dunn*, 3060-61.

71o. Preservatives : Cream :
  Would stop the sale, *Hudson*, 538.
  In appreciable quantity, at Newport (Mon.), *Jones*, 1309.

71p. Preservatives : Dairy Produce :
  Desired by central and associated Chambers of Agriculture ; motive mere guess work, *Carrington Smith*, 4487, 4554-57.
  Absolutely of preservatives in milk and butter advocated by Mr. Lockwood, *Womack*, 7507.

71q. Preservatives : Meat :
  At Newport (Mon.), in appreciable quantity, in prepared meats, *Jones*, 1309.

71r. Preservatives : Milk :
  In Newport (Mon.), *Jones*, 1309.
  Should be effected, *Voelcker*, 1716 ; *Cripps*, 1954, 1957 ; *Hehner*, 5608.
  Of boracic acid, would not raise price, *McFadyean*, 1773.
  Would not render fresh appearance and taste of milk difficult of attainment, *McFadyean*, 1774.
  Would not seriously affect urban supplies, *Walford*, 1909-10, 1928.
  In force in Austria, France, Germany, *Walford*, 1929.
  No reason against in England, *Walford*, 1930-31.
  Should as regards boron be absolute, *Williams*, 2112, 2140, 2169-70.
  Would affect small vendors, and might lead to monopolies or co-operative associations, *Williams*, 2245-56.
  Absolute in New York State, *Hill*, 2452-53 ; in Belgium, Austro-Hungary, and parts of Switzerland, 2454.
  Feasible in Birmingham, *Hill*, 2455.
  Should be prohibited by law, *Hill*, 2499, 2500, 2506.
  Should be absolute as to all, *Mann*, 2627-28 ; *Robinson*, 3335-38 ; *Hehner*, 5608.
  Needed, *Annett*, 2685.
  Continued experiments on kittens, yielding results like those of Annett, would suffice to prohibit preservatives in milk, *Boyce*, 2777-80.
  Would throw much milk on dealers' hand at present, *Brierley*, 3179-80.
  Boracic acid should not be added to milk, *Robinson*, 3336-37.
  Enforced for Guy's Hospital milk as unnecessary and inadvisable, *Stevenson*, 4800.
  Trade need not suffer, *Corfield*, 5088-89.
  Should be absolute, *W. C. Williams*, 5220.

71. PROHIBITION—*continued.*

71r. Preservatives: Milk—*continued.*
Desired, *Hope*, 6888. Need not dislocate the trade, 6898.
Of preservatives has been held to be likely to advance price of milk, *Sorensen*, 7114. It need not do so, as evidenced by Copenhagen and Manchester, 7115.
Advocated by Mr. Lockwood, *Womack*, 7507.

71s. Preservatives: Wine:
Of salicylic acid in wines contracted for by Messrs. Gilbey, *Gilbey*, 4362, the acid also being prohibited in many wine producing countries, 4364, 4380, including France, 4370. Formaldehyde also prohibited by Messrs. Gilbey, 4368. Their wines tested for preservatives, 4396-4403 and footnote.

72. Salicylic Acid:
Should be entire, as a food preservative, *Cameron*, 2546-47; *W. C. Williams*, 5275-76.
Enforced in Austria, *Corfield*, 5098, 5100.
Would feel inclined to forbid use of salicylic acid, *Starling*, 6943.
Should be absolute; a dangerous drug, *Halliburton*, 7551-53.

73. PUBLIC ANALYSTS:
Should be placed in a position wherein they can speak on the authority of Governmental decisions on the question of the relation to health of added preservatives and colouring matters in food, *Cassal*, 3788.

74. PYROLIGNEOUS ACID:
Used as a preservative, *Corfield*, 5086.
Prohibition desirable, *Corfield*, 5087.
Used for painting "smoked herrings," *Poore*, 7385.

75. QUALITY:

75a. Bacon: American:
Perfection has led to enormous increase of trade, *Bennett*, 173, 174.

75b. Bacon: Canadian:
Superior to home products, *Bennett*, 137.

75c. Bacon: Home:
Firmer and harsher in cure than Canadian, *Bennett*, 137.

75d. Butter:
Weather affects texture, *Lovell*, 739, 772.
Variety in creameries and factories due to handling, manufacture, method of supply, and defective water supply, *McCracken*, 2947-48.
"Mixtures" not made at Dunragit, *McCracken*, 2997.
Preservatised butter is insipid, *Long*, 4671.

75e. Butter: Australasian:
Finer winter article than Danish, *Lovell*, 730.
Freezing affects butter, *Cameron*, 6168. All New Zealand butter comes frozen, 6169, and defrosting tends to depreciationof the butter if not preservatised, 6171, 6202, 6295-97.

75f. Butter: Brittany:
More moisture than in Danish, *Trengrouse*, 635-36.

75g. Butter: Danish:
Remarkably good, *Kellitt*, 45-47.
Closer texture than Irish, *Dale*, 257.
Contains less water than Irish, *Dale*, 258.
Solid and free from moisture, *Trengrouse*, 635, 674-75; *Lovell*, 773.
Pasteurising has detracted from, *Lovell*, 729.
Has deteriorated, *Clement*, 1510-11.
Cannot compete with Normandy fresh, *Bannister*, 3504.
Finest under 2 per cent., very best class not over 1 per cent. of salt, *Bannister*, 3509-13.
Compares with old Irish butter, which was salty, and tub butter; Danish butter a substitute therefor, *Bannister*, 3517-20.

75. QUALITY—*continued.*

75g. Butter: Danish—*continued.*
Flavour of Danish butter not lost by pasteurisation, but not so fine as English prime butter, *Long*, 4668; and cannot be made so fine, 4669.
Good, *Hehner*, 5602.

75h. Butter: Irish:
Secondary, *Kellitt*, 44.
Mild-cured largely prepared for English market, *Dale*, 263-64.
Much equal to Danish, *Dale*, 262.
Sold as cold store butter if more than a fortnight old, *Shanahan*, 465-68.
Relatively weak, *Lovell*, 737-40, 772.
Affected by food, *Lovell*, 738, 772.
Affected by wet weather, *Lovell*, 739-40.
Greatly improved of late, *Clement*, 1510.
Some equal or superior to Danish, *Bannister*, 3521.
Using Danish methods, Ireland could turn out equally good butter, *Long*, 4658.

75j. Butter: Normandy:
More moisture than in Danish, *Trengrouse*, 635-36.
Finer than Danish, *Lovell*, 730.
Fetches a higher price than Danish, *Bannister*, 3505.
Factory butter, *Bannister*, 3513-14.

75k. Milk: Boracised:
Often watered, but may have to with method of admixture, *Blyth*, 3442-43
No change in milk effected by boracic acid, and hence the milk is fresh, *De Hailes*, 3970-71.

76. QUANTITY:

76a. Boracic Acid:
Should be restricted, *Blyth*, 3468.

76b. Boracic Acid in Bacon:
Four ounces per 100 lbs. of meat; sometimes 1 lb. used, *Prossor*, 569, 588-89.
One per cent. used and needed, *Gregson*, 877-80, 883-87.
Amount never determined, *Boseley*, 1040-44.
For mild-cured bacon and ham, from 4 ozs. to 1 lb. of boracic acid per 112 lbs. of meat, in powdered form, *Bannister*, 3649-53.
A little might be allowed, *Stevenson*, 4832-33.
Found up to 62 grains per lb., *W. C. Williams*, 5169-70.

76c. Borax on Bacon:
Canadian, 4 ozs. to 56 lbs., *Bennett*, 128-30, 184-87.

76d. Boracic Acid in Butter:
One per cent. kept butter nine months, *Sandes*, 107-10.
Has found 2½ per cent., *Lovell*, 787.
Three-quarters per cent., keeps butter for three or four months, *Dale*, 250, 282 290-91.
Less than one-half per cent. not sufficient *Dale*, 287-89.
One-half per cent. required, *Shanahan*, 344-45, 354-55; and impressed on consignors, *Lovell*, 719-20; a necessary minimum, *Lovell*, 790-92; and ample, *Clement*, 1518.
Factories advised to use ½ per cent., *Trengrouse*, 646.
Traders at mercy of consignors, *Trengrouse*, 649.
Three per cent. highest known, *Trengrouse*, 678.

76e. Boracic Acid in Cream:
One-quarter per cent. sufficient to keep for four to six days, *Hudson*, 515, 526-30.
More than one-half per cent. unnecessary, *Hudson*, 526-27.

76f. Boracic Acid: Milk:
Traces of boracic acid found, *Wild*, 1442.
Has found $\frac{1}{1000}$, *Wild*, 1443.
In $\frac{1}{1000}$ boracic acid keeps milk sweet for 24 to 48 hours, save in extreme heat, *Wild*, 1429.
Should not exceed 3 grains in a quantity to be consumed by a child, *Walford*, 1876.
Lowest found, 0·004 per cent., *Walford*, 1832.
Highest found, 0·105 per cent. *Walford*, 1832.

76. QUANTITY—*continued.*

76f. Boracic Acid : Milk—*continued.*
In separated milk, 28 grains per gallon, *Hill*, 2367.
From 21 to 126 grains per gallon found, *Hill*, 2334.
Reasons for differences vary, *Hill*, 2335.
Varying in Leeds, highest being 20 grains per gallon, *Cameron*, 2528-30.
Non-limitation would be difficult, *Boyce*, 2775.
Forty grains in milk would show meddling with milk, *Bell*, 2818.
Five grains per pint of milk quite safe, *Bond*, 3089.
Unnecessary and unusual to add 26 grains per pint, but nothing to prevent it, or repeated dosing of milk, *Bond*, 3099, 3100, 3102.
For young children 4½ grains per pint not safe, but poor children not likely to get that amount, *Brierley*, 3247-51.
Thirty-five grains per gallon sufficient, *Brierley*, 3175.
Eighty grains per pint found in December sample, *Blyth*, 3439-46.
Sixty grains per gallon found, *Bannister*, 3636.
Person on milk diet might consume nearly 20 grains of boracic acid, *Rideal*, 3692.
Quantity equal to 59 grains of boron-trioxide, and 101 grains of crystallised boracic acid found per gallon of milk, *Cassal*, 3816, 3865.
Smallest quantity determined equal to 19 grains per gallon of crystallised boracic acid, *Cassal*, 3817.
Would not allow 80 grains of boracic acid per pint, *Foulerton*, 4155.
Over 100 grains per gallon found, and conviction obtained, *Fisher*, 4736, 4762 ; boracic acid used recklessly, 4763-64.
Has found 20 grains in a sample, probably result of repeated dosage, *Kaye*, 5459-62.
Eighty grains to the pint of milk a very large dose, *Attfield*, 6560-61 ; but probably an isolated case, 6562.

76g. Borax in Butter :
Infinitesimal, *Bennett*, 150.
Heavily boraxed butter would be rejected, *Bennett*, 211-13.
Excessive quantity needed to flavour butter to point of rejection, *Bennett*, 215, 218.
No proceedings known on account of excess of weight, *Bennett*, 221-26.

76h. Borax and Boracic Acid in Butter :
Only minimum requisite amounts used, *Lovell*, 718, 737.
One-half per cent. keeps butter three or four days, *Lovell*, 725, 783, 793.
Analyses for, frequent, *Lovell*, 775.
Samples found to yield 0·71, 0·74, and 1·3 per cent. (over 90 grains per lb.), *Jones*, 1309, 1322.
Limit of use not determined, *Jones*, 1310, 1312, 1385.
Percentage of 0·25 said to be needed, *Walford*, 1861-62.
Dr. Dyer found an average of ½ per cent., and in $\frac{2}{30}$ boracised samples over 1 per cent., *Fisher*, 4717-21.
Preservatised with 0·77 per cent., *Kaye*, 5458.
Daily dosage in butter not likely to be large, *Kaye*, 5507-8.
Butter going to Great Ormond Street Hospital has been found to contain 17·4 to 47·6 grains of borax per lb., and has been given to children, no ill-results noted, *Still*, 6814.
Very little taken, and that only by a few, 6815.

76j. Preservatives : Milk :
Quantity found :
From 13½ to 210 grains found per gallon, *Williams*, 2116-18, 2121.

76k *Quantity used :*
One half to one oz. per 16 gallons, *McCracken*, 2878-79.
Need not exceed 30 grains or so per gallon, *McCracken*, 2928.

76. QUANTITY—*continued.*

76j. Preservatives : Milk—*continued*
76k. *Quantity used*—continued.
One hundred grains per gallon of dissolved preparation outside Southampton, in summer only, *Brierley*, 3174, 3177.
Larger amounts than vendors declare to be necessary, *Brierley*, 3212-13.
Should be restricted, *Rideal*, 3693.
Liable to be in needless quantity, *Cassal*, 3812.

76l. Preservatives : Quantity :
An important factor, *Walford*, 1873.
Useful, questionably harmless, *Walford* 1874.
Maximum limits should be insisted on, *Vasey*, 2058, 2076.
Should be restricted, *McCracken*, 2931.
Higher proportions than $\frac{1}{50000}$ of formaldehyde and $\frac{1}{2000}$ of borax and boracic acid mixture might be taken ; question one of idiosyncrasy ; these amounts safe, if declared, for majority of persons, and would suffice for trade purposes, *Rideal*, 3691, 3694-96.

76m 1. Preservatives : Butter :
Weighed very exactly, *Sandes*, 97 ; same proportion whole year, *Sandes*, 104 ; one-half per cent. not enough, *Shanahan*, 343 ; three-quarters per cent. requisite, *Shanahan*, 375-78.
One-half per cent. sufficient, *Hudson*, 492 ; and never exceeded, 499.
One per cent. ample, *Clement*, 1518 ; 17 grains per lb. enough, *Williams*, 2129.

76m 2. Preservatives : Butter :
Quantity found :
From 1 to 112 grains per lb., *Williams*, 2125, 2125*.
Very small quantity to 1 per cent. *Hehner* 5566.

76n. Preservatives : Cream :
Should be limited and standardised, *Voelcker*, 1749-50.

76o. Preservatives : Milk :
Should be limited and standardised, *Voelcker* 1749-50.
If useful, might be distinctly dangerous *McFadyean*, 1752.

77. RENNET :
One sample found to contain boracic acid preservative, *Voelcker*, 1685-86.

78. RESTRICTIONS AS TO USE OF PRESERVATIVES :

78a. Boracic Acid : Indiscriminate Use :
Objectionable in food, *Walford*, 1883.
Prohibition of indiscriminate use of boracic acid should be enforced if large doses are put into milk, *Attfield*, 6562-65.
Should not be used indiscriminately in milk, *Anderson*, 7207.

78b. Boracic Acid : Butter :
Stipulations :
None as to factory butter, *Dale*, 321-25.
None, *Trengrouse*, 649.

78c. Preservatives : Indiscriminate Use :
Legislation as to undue use advocated, *Lovell*, 722, 724.

78d. Preservatives : Restrictions :
Restriction to one preservative material and to a limited quantity should be enforced on vendors, and use allowed only in three hot months of the year, *Long*, 4689.
Restriction on the use of preservatives desirable, *Fisher*, 4726, 4737 ; boracic acid in milk being instanced, 4728 ; and a superior limit called for, 4732 ; though some difficulty might arise in cases, 4733-35 ; and especially as to formaldehyde, 4741-42 ; at present, 4752 ; limit should be placed on preservatives on salted and preserved meats (as ham and bacon) and fish, 4745.

78. RESTRICTION AS TO USE OF PRESERVATIVES—*continued.*

78d. Preservatives : Restrictions—*continued.*
Regulation required of quantities of preservatives permissible, in gradually diminishing amount in butter, as facilities to obviate their use come in, *Hehner*, 5605-6.
Restriction of quantity of preservatives by limitation inoperative, *Richmond*, 5753-54.
Restriction rather than declaration of preservatives advocated, pending prohibition, *Lough*, 6662; latter might handicap the trade, 6662-63. Would like to know if he were taking a harmful preservative, 6669-72. Consumer has a right to know, 6673-75; but not as to butter only, 6675.
Indiscriminate use should be remedied, *Hutchison*, 6722, 6749.
Chemical preservatives in food studied, *Brunton*, 7425-26. Use should be regulated, because of double danger of undue use, 7427.
Preservatives not strongly objected to, *Womack*, 7478; but regulation desirable, 7479.

78e. Preservatives : Unrestricted Use :
A great danger, *Voelcker*, 1676.
Indiscriminate and reckless use of preservatives objectionable; 150 grains of salicylic acid found per gallon of British wine, *Hope* 6842, 6923.

79. SALE OF FOOD AND DRUGS ACT :

Administration :
Sampling not extensive in Newport (Mon.) *Jones*, 1401-4, 1406.
In Cardiff, population 186,000 persons, 600 samples of food and drugs analysed annually, *Walford*, 1821-24, 1909.
Analysis made of vended samples of milk and butter in County Glamorgan, *Williams*, 2113-14.
Bacon not an "article of food," *Brierley*, 3199, 3200.
Law as it stands presents practical difficulties as to preservatives and colouring matters in the public interests, such interests being the reason for the Sale of Food and Drugs Act, *Cassal*, 3794.
Trained inspectors necessary for the obtaining of average samples of food, *Hope*, 6875-77.

80. SALT :
A food, and common to the body, *McFadyean*, 1776; *Mann*, 2628.
A feeble preservative, less potent than boracic acid, *McFadyean*, 1776-77.
Cannot compare with boracic acid as a preservative, *Mann*, 2628.
Bulk for bulk more harmful than boracic acid, *Bell*, 2791-92.
A constituent of the human body, *Corfield*, 5085.
A food, *Hehner*, 5637-38.
Salt scarcely more a food than boracic acid, *Attfield*, 6549; but it is a component of the human body, 6550. Salt betrays its presence in food, 6551.

80a. Bacon :
Washed off after cure, *Kellitt*, 15.
American formerly cured by, and packed in, *Kellitt*, 15.
Cannot be extracted by steeping, *Kellitt*, 15.
Excess reduced by use of borax, *Kellitt*, 15, 73-74.
Used in curing, *Kellitt*, 16.
Conceals defects, *Trengrouse*, 656-57.
American, replaced by boraxed bacon, *Kellitt*, 15, 29, 33-35.
Led to complaints, as to excess of salt, *Kellitt*, 15.
People will not eat, *Kellitt*, 29, 31.
Held in check by borax, *Bennett*, 145-47.
Salted goods not appreciated, or saleable, *Bennett*, 176-78; *Prossor*, 559-60; *Trengrouse*, 665.
Much would be needed if preservatives were not used, *Prossor*, 570.
Replaced by preservatives, *Gregson*, 858; but used for packing 25 per cent. of American and Canadian meats, *Gregson*, 859-61.

80. SALT—*continued.*

80a. Bacon—*continued.*
Cost, 30*s.* per ton, *Gregson*, 888.
Packing renders meat too salt, *Gregson*, 871, 875, 896.
Absorbed by bacon, *Gregson*, 897, 931-33.
Percentage used in cure, 5 to 10, and even 20 per cent. in Irish bacon, *Gregson*, 927-28.
A good deal runs to brine, *Gregson*, 928.
No Canadian meat comes salted, *Sinclair*, 936.
Hurtful to mill hands, *Davidson*, 1599, 1600.
When it was used, less eaten, and more cheese eaten, *Davidson*, 1601-3.

80b. Butter :
Heavily salted not now in demand or saleable, *Kellitt*, 43; *Dale*, 241-42; *Hudson*, 493-94; *Clement*, 1520.
In excess, as injurious as borax, *Kellitt*, 43.
Three lbs. to 112 lbs. of butter, *Sandes*, 79.
Almost entirely replaced by preservatives, *Sandes*, 80; *Dale*, 243.
English customers no longer take heavily salted Irish butter, *Sandes*, 80.
Heavily salted butter contains six to seven per cent. of salt, *Sandes*, 84.
Return to heavily salted butter impossible, *Sandes*, 89.
Price lower than unsalted butter, *Sandes*, 94 105.
Some people prefer salt flavour, *Sandes*, 85, 86.
Needs to be evenly distributed, *Shanahan*, 387.
All heavily salted, years back, especially Irish butter, *Hudson*, 493-94.
Margarine would replace insistence on it, *Clement*, 1520.
Vastly different from fresh butter, *Clement*, 1556.
Should alone be added, on physiological grounds, *McFadyean*, 1756, 1758.
Heavily salted, not now pleasing to public taste, *McFadyean*, 1760.
Some samples preservatised, *Williams*, 2127-28.
In less favour than formerly, *McCracken*, 2857.
Tends to evaporate, *Gibson*, 6363.

80c. Butter : Borax :
Held in check, *Bennett*, 145-47.

80d. Butter : Danish :
More than in Irish, *Dale*, 265.
One per cent. or more, *Trengrouse*, 630, 654.
No fresh butter imported, *Lovell*, 717, 771.
Salted to taste, *Riley*, 833.
Contains a little salt, *McCracken*, 2859-60.
Only, contained, *Bannister*, 3504.
About two per cent., but amount varies, *Bannister*, 3507-8
Most salted to some extent, some not salted, some ¼, but most one per cent., *Faber*, 4221-22.
Danish butter contains, some of it 2½ per cent. and some three and four per cent. of salt, *Gibson*, 6361-62.

80e. Butter : Irish :
Used, *Dale*, 275.
Not in large amount, *Dale*, 276.
Same as Normandy, *Dale*, 265.
None in fresh butter, *Dunn*, 3028.
Some old butter was not heavily salted, made in summer, without abnormal quantity of water, with exception, *Bannister*, 3522-31.

80f. Butter : Normandy :
Only salted butter imported 40 years back, *Lovell*, 713.

81. SALTPETRE :
Bulk for bulk more harmful than boracic acid, *Bell*, 2791-92.
Would spoil milk, *Bell*, 2819.
Used as a preservative, *Corfield*, 5086
Prohibition desirable, *Corfield*, 5087

81a. Bacon :
Used in curing, *Kellitt*, 16.
(*See also* under Cure.)

82. SANITARY CONDITION OF DAIRY FARMS:
Chief London agencies look to it, *Foulerton*, 4108-11.
Factor in determining keeping quality of milk, *Foulerton*, 4112.
Gross neglect of ordinary precautions and sanitation where preservatives used, *Tubb-Thomas*, 4948.
Sanitary improvement in rural districts put back by use of preservatives, *Tubb-Thomas*, 4946, 5027. Some farms in such a state as to render milk impossible of delivery without preservatives, 5027-32. Dairies, &c., order not generally enforced, 5033-36. Proper water supply would result from enforcement, 5037-38.
Precautions adopted by Aylesbury Dairy Co. to secure proper milk supply from farmers, *Hattersley*, 5818-19, and farms inspected, 5820.

83. SLIME:
Bacon:
Obviated by borax, *Kellitt*, 15, 73, 74; *Gregson*, 871, 896.
Sprinkled borax remains dry, *Gregson*, 929.
Moisture prevented by borax, *Kellitt*, 11, 12, 23; *Prossor*, 598, 607-9.

84. SODIUM FLUORIDE:
Not a good anti-fermentative, *Boseley*, 1046.

85. SODIUM HYPOSULPHITE:
Taken from 15 to 45 grains per diem, prevented discomfort attending fibrous foods, but at times unpleasantness resulted, *Attfield*, 6539-44, but experience not of same value as that with boracic acid, 6545.
Sulphite of sodium in meat heard of, 6913, but not inquired about, *Hope*, 6914.
Irritant properties of sodium sulphite comparable with boracic acid, *Starling*, 6979. Has never prescribed the sulphite, 6980.

86. STANDARD:
86a. Boracic Acid in Butter:
Needed, *Trengrouse*, 660, 702.

86b. Milk:
Three per cent. of fat stipulated for, and all milk tested by Manchester Pure Milk Supply Co.; average 3·5, *Sorensen*, 7065-70. Has fallen to 2·7 on a single day in August, 7071.
Evening and morning milk differ in quality, *Sorensen*, 7093-96, and evening milk may be diluted to quality of morning milk, 7097-98.

86c. Preservatives:
Desirable, limiting use, *Vasey*, 1997-2001, 2003, 2050-51, 2058, 2076.
Standardising of fresh preservatives advocated, *Cameron*, 6242.
Standardising of preservatives desired, *Hutchison*, 6723.

87. STERILISATION:
Milk should be sterilised, and a little boracic acid added, *Bell*, 2847-48.
Not sterilised at Dunragit Creameries, *McCracken*, 2894-98.
Digestibility of sterilised milk said to be less than ordinary, *Foulerton*, 4161-62.
Sterilisation would help to keep milk, *Foulerton*, 4070, especially if bottled, 4071, but then expensive, 4072, as illustrated by Paris hospital practice, 4073, but expense mainly a matter of management, 4074-75. Sterilisation would be beneficial in the interests of the community, 4187, but its destructive effect on the tubercle bacillus doubted, 4188-93, but the heating of milk to 65° Centigrade would be a benefit, 4194. If practicable sterilisation would be the best thing, 4198.
Sterilisation practised by witness, *Long*, 4594; on small scale, 4599, but in places on a very large scale, 4600; process described 4595-98. Bottle cleansing is a trouble, 4601. Bottled milk used in Switzerland 4602. Milk cannot be tampered with in transit, 4603, and delivery is less frequently needed, 4604. Cleansing of bottles more difficult than of cans, 4697-4701, unless daily service in question, 4702. Bottling of milk on a large scale need not raise the price, 4707-9.

87. STERILISATION—*continued.*
Held to tend to innutrition, *Stevenson*, 4804.
Milk should be strained, cooled, and sterilised, *Tubb-Thomas*, 5039-40.
Refrigeration, sterilisation, and pasteurisation on different footing to preservatives in milk, *Kaye*, 5499-502. Recommends sterilisation of milk, 5559. Doubts its indigestibility, 5560. Growing in use in Ripon, 5561.
Some nursery milk delivered in bottles, *Hattersley*, 5884-86, from special farms, 5893. Bottled milk entails expense, 5887-88. Paris has bottled milk at 6*d.* per quart, 5889. Copenhagen gets both bottled and can milk, 5890-92.
Sterilised milk demand increasing, *Hattersley*, 5784. Milk heated to 212° F., 5785, and fairly large trade done by Aylesbury Dairy Co., 5786. Delivered in bottles, 5885.
Salicylic acid as ineffective as boracic acid as to milk sterilisation; milk practically saturated, $\frac{1}{400}$, not sterilised, *Blaxall*, 6070.
Sterilisation preferred as an alternative to chemical preservatives, *Hope*, 6899. Infantile scurvy never heard of in association with sterilisation, 6900-1. Evidence to the contrary as to sterilised humanised milk, 6902-7.
Sterilised milk not likely to produce scurvy—that is, mal-nutrition, *Starling*, 6946. Infantile scurvy said to prevail most in higher classes, 6947-48, who use most sterilised milk, 6949, hence cause and effect presumed, 6950-52. No direct experiments made, 6953.
With cooling of milk would obviate need for preservatives, *Brunton*, 7444.
Sterilised milk held by some to be injurious, not so held by witness, *Brunton*, 7445, but our knowledge may be defective, 7446-47, the raising of milk for a short time to 180° F. being in question, 7448.
Sterilised milk not known to be harmful, *Halliburton*, 7580-82.

87a. Butter:
Not essential, *Voelcker*, 1743-47.
(*See also* Pasteurisation.)

88. STRYCHNINE:
Injurious, *McFadyean*, 1801-2.

89. SUGAR:
Defensible in fruits, *McFadyean*, 1776.

90. SULPHUROUS ACID:
Not to be classed as an antiseptic with formalin; it keeps changing into a sulphate, a natural constituent of beer, and is not dangerous, *Bannister*, 3672-74.
Found in British wines, vinegar, pickles, &c., and probably harmless as used, *Fisher*, 4746.
(*See also* under Beer.)

91. TRADE:
91a. Bacon:
Week to week, *Davidson*, 1620-21.
Bacon brought in as is fresh meat would not be in same condition as borax-packed bacon, *Bannister*, 3501.
English bacon trade very small compared with American trade, *Harris*, 6015-17.

91b. Bacon, American:
Began 50 years ago, in crude form, *Benne* 173.
Increase enormous of late years, *Bennett*, 173 174.

91c. Bacon, Home:
Small, because unpopular, *Bennett*, 131-32.
Relation to imported produce small, *Benne* 161-62.
Small compared with American trade, *Harris* 6015-17.

91. TRADE—*continued.*

92a. Butter :
Many changes in last 50 years, *Hudson*, 492.
Long experience, *Lovell*, 706-7.
Greatly developed of late, *Lovell*, 708-11.
People do not want preservatised butter, *Long*, 4658.

92b. Butter, Australasian :
Increasing, at lower price than Danish, *Trengrouse*, 650.
Introduction has brought down Danish prices, *Trengrouse*, 702.
Seasonal only, *Davidson*, 1623-24, 1626-28.
Output sometimes small, by reason of drought, *Davidson*, 1630-31.
New Zealand butter output increasing, *Cameron*, 6155, 6214-15, and quality steadily improving, 6156, owing to instruction and inspection, 6157. Small in comparison with colonial trade generally, 6228-33. Retail same as export, 6247.

92c. Butter, Brittany :
Chiefly with London, *Trengrouse*, 692.

92d. Butter, Danish :
All year round trade, supplanted Irish seasonal trade, *Bannister*, 3534-35.
Trade in Danish butter not affected by preservatised French and Irish butter, *Faber*, 4224. It is about ½ of foreign butter trade of England, 4316.
Agricultural pursuits occupied about half Danish population, *Faber*, 4244-47, in 1890, about ⅗ths, footnote to 4247.
All year round, *Gibson*, 6318-19.

92e. Butter, Irish :
Regaining lost ground, *Dale*, 261, 297.
Increasing, *Hudson*, 538 ; *Gibson*, 6396.
Has increased threefold in recent years, *Hudson*, 542-44.
Hampered by manufacture in small quantities, *Lovell*, 750.
Foreign butter a competitor, Australasian butter takes the place of the old Irish winter trade butter, *Dunn*, 3016, 3050.
Lost the market by being only a seasonal trade, *Bannister*, 3533-35.
Mainly summer trade only, *Gibson*, 6317. It need not be so, 6323-24, as witness has endeavoured to show farmers, 6325, with some success, 6326.
Milk in Ireland in winter months sent into towns, thus interfering with butter trade, *Gibson*, 6317, 6321-22.
Calving cows largely housed in Ireland in winter, *Gibson*, 6320. Irish trade such that butter must keep for months, 6353, 6394, and does.

92f. Butter, Normandy :
Chiefly with London, *Trengrouse*, 692 ; entirely a South England commodity, *Riley*, 827.

92g. Canadian Hog Products :
Increase enormous in last ten years, *Bennett*, 130, 233-36.

93. TRANSIT :

93a. Butter :
From varying parts to Aylesbury Dairy Co., *Boseley*, 1023, 1028-29.
Can be brought long distances without preservatives, *Jones*, 1309, 1315, 1339-41.
Transit of butter in Ireland the curse of the trade, *Lough*, 6637-6639. Redress hoped for at the hand of the new Agricultural Board, 6638. No traders' rolling stock in Ireland, 6640. Procedure for compensation very unsatisfactory, 6641. Matters in Ireland worse than in Denmark, 6687.
Transit of butter in refrigerator cars in New Zealand, *Sorensen*, 7164, and of butter and milk, also in Denmark, 7165-68. None such in Manchester, 7169-70.

93b. Butter, American :
Used to spoil it, prior to use of preservatives, *Lovell*, 712

93. TRANSIT—*continued.*

93c. Butter, Australasian :
On board ship five to six weeks, *Trengrouse*, 677, Comes to England from December to May or June, *Cameron*, 6216. Butter reaches consumer in England in 11 weeks from manufacture, 6248-49. Complaints of butter have been made, but kind of butter no known, 6250-51.

93d. Butter, Irish :
To a distance in hermetically sealed tins, *Dale*, 272.
To England from Cork practically similar to Denmark, *Dale*, 293-96.
To Scotch market from Western Ireland three days ; to London four days, *McCracken*, 2942-45.
Transit of butter from New Zealand under best possible conditions, *Gibson*, 6331, from Ireland and in England, under very worst possible conditions by railways and steamship companies, 6331-33, 6343-45 ; many complaints, 6334, and practically no redress, 6335. Specific complaints instanced, 6332-33, 6337-42. Danish and Swedish Governments see to such a matter, 6336, and get a better service, 6386-89. No improvement in handling the butter by railway companies, 6346-49. Improved transit needed, 6397.

93e. Cream :
Partly from Wiltshire for Aylesbury Dairy Co., *Boseley*, 1038.

93f. Milk :
Long distances render preservatives necessary, *McCracken*, 2869.
Some comes from Scotland to London, *McCracken*, 2872-74.
Of skim-milk from Scotland to London, costly, *McCracken*, 2911-12.
Related to use of preservatives, *Blyth*, 3480-81.
Transit to London practically limited to two trains daily, from a distance, and evening's milk 12 and morning's milk 24 hours old on reaching consumer, *De Hailes*, 3903-17, 3948.
Aylesbury Dairy Co. draw milk from a distance without preservatives, *Foulerton*, 4158-59.
Sent to London from Hampshire and Hertfordshire, *Long*, 4611-13.
Transit of milk by rail may need improvement, 4970. At present harm may accrue, *Tubb-Thomas*, 4971-73. Matter easy of rectification, 5045.
No difficulties of transit by rail, *Hattersley* 5778. Milk occasionally sent in a fish truck, 5779-80. Churns sealed during transit, 5824-26. Trade of Aylesbury Dairy Company 1½ million gallons yearly, 5841-43, from 50 farms, 5844, averaging 50 miles away, 5845. Some 100,000 persons supplied annually, in 14,000 households, 5848-53, over a wide London area, 5894-95. Milk comes to Paddington and Euston, 5896-97. Many poor class customers, 5898.

94. UNSALTED :

94a. Butter :
One lb. of preservative to 112 lbs. of butter and mild salted butter with 3 lbs. of salt in addition, *Sandes*, 79.
Mild cured still marketable, *Sandes*, 84.
Must needs be good to fetch its price, *Sandes*, 94, 105.
Price higher than salt butter, *Sandes*, 94, 105.
Little made in winter, *Sandes*, 105.
Would not keep for 24 hours in hot weather without preservative, *Dale*, 265.
Now in demand, *Lovell*, 710.

94b. Butter, Irish :
Now sent, *Lovell*, 741-44.

95. WATER :

95a. Butter, Irish :
From 12 to 13 per cent., *Dale*, 306-7 ; 13½ to 15 per cent., *Lovell*, 770 ; 14 to 15 per cent *Dunn*, 3039.

95. WATER—*continued.*

95a. BUTTER, Irish—*continued.*

Seasonal variations, from 10 to 23 per cent., *Dale*, 308-9.
No standard, *Dale*, 308-9.
Excess may lead to preference for Danish butter, *Dale*, 310-12.
More than Danish, *Lovell*, 767.
Cannot be reduced to Danish proportion, *Lovell*, 770.
With less moisture would surpass Danish, *Clement*, 1510.
Not so dry as Danish or Australian, *Dunn*, 3024, 3037-38.
Question investigated by Munster Agricultural Institute, *Dunn*, 3024, 3037-38.
If 18 per cent., butter not Cork-branded; would betoken negligence; if 20 per cent. prosecution used to and might still ensue, *Dunn*, 3040-46.
Pressing out requires great care in hot weather; but very cold water in skilled hands would ease matters, *Dunn*, 3047-49.
Same as in good butter, *Long*, 4644.

95b. BUTTER, Scotch:

Amount in Scotch butter unknown; less than in Irish butter; dry as Danish butter, *McCracken*, 2994-96.

96. WATER SUPPLY TO FARMS:

Many farms have none for cooling milk so as to render preservatives less needful, *McCracken*, 2924.
Should be proper in all cases, *Cassal*, 3863-64; *Kaye*, 5524-26.

97. COLOURING MATTERS:

Not troubled about, *Jones*, 1407; not specially worked at, *Wild*, 1487; used, but no personal knowledge of, *Walford*, 1922-26; not studied, *Cripps*, 1974; not studied apart from copper, *Mann*, 2623-25; not studied, *Bond*, 3138-39; not much studied, *Corfield* 5133-34.
Studied a little, *Hill*, 2479-80.
Present difficulties, *Cassal*, 3838-41.
List handed in, *Carrington-Smith*, 4463-66 (App. No. 11).
Some named, *Fisher*, 4778.
Chromate of lead and oxide of iron known to be used, *Fisher*, 4780.
Colouring matters of late have undergone change for the better, especially in sweetmeats, no noxious dyes being now found, *Stevenson*, 4837, nor for 20 years past, 4838-39. Regulation a question of expediency. Colourings varying constantly, 4842. They should be scheduled, after experiments, 4843, which are essential, 4844-45.
Colouring matters not subject of evidence by St Bartholomew's Hospital, *Womack*, 7509.

ANALYSES:

Often difficult by reason of small sample, *Blyth*, 3364, 3369.
Almost any aniline dye can be detected, in relatively small quantity, *Blyth*, 3367-68.
Dyeing test to silk often required to detect colourings, *Cassal*, 3848.

ANCHOVY SAUCE:

Used, *Copeman*, 1178.
Red earth used for essence of anchovies, *Blackwell*, 4889.

ANILINES:

Aniline dyes rare years ago; but for last 8 or 9 years sweetmeats and other articles coloured with coal-tar colours, *Blyth*, 3351-53, 3366.
Aniline colourings not found in dangerous proportions in any one article; but accumulated effects of many articles so coloured might injure a child, *Blyth*, 3358.
Becoming more general for milk, *Boseley*, 1098-1100.
Used at times for milk, *Hill*, 2485-86; *Cassal*, 3844.
Used in sweets and peppercorn, *Voelcker*, 1666-69.

97. COLOURING MATTERS—*continued.*

ANILINES—*continued.*

No doubt used in dairy produce, *McCracken*, 2958-59, 2967-77, 2981-90, 3000, 3001.
Used in vegetables, *Blyth*, 3356.
Used for confectionery and sugar, *Cassal*, 3847-48.
Now much used, in very small quantity; not sufficient to harm, *Hehner*, 5568-70.
Used in dairying trade, in extremely small amount, about $\frac{1}{100000}$, *Richmond*, 5760, 5763-64.

ANNATTO:

Never analysed, *Boseley*, 1078-79.
Only colour used by Aylesbury Dairy Co., *Boseley*, 1097, 1102-4; and its nature and constitution described, *Richmond*, 5759.
Spanish, used in butter and cheese, *Copeman*, 1178, 1282.
Non-injurious, *Copeman*, 1178, 1282.
Simplest colouring agent; used in butter as well as milk, *Brierley*, 3284-86.
In chief use in dairy produce, *Boseley*, 1050; *McCracken*, 2956-57; also with anilines, 2983-84; *Carrington-Smith*, 4467-72.
Harmless, *Long*, 4684.
In most milk, *Sorensen*, 7083.

BACON AND HAM:

Saltpetre used, *Hudson*, 508.

BEER:

Only natural colouring found, *Blyth*, 3419.

BEVERAGES:

Temperance drinks coloured, *Fisher*, 4779.

BUTTER:

Added, *Dale*, 281, 326.
Irish butter only needs in winter, *Dale*, 327.
Fluid used, *Dale*, 328-29.
Use of saffron, *Dale*, 328-29, 334.
Tested; name not known, *Dale*, 330-33.
Use of annatto, *Dale*, 334; *Trengrouse*, 638-39.
Best retentive colour decided on, *Dale*, 334.
Vegetable only, *Dale*, 336-37.
Aniline dyes not used, *Dale*, 337.
Used only in winter, *Hudson*, 531.
Needed only to satisfy local public demands, *Lovell*, 734-37.
Not usually fraudulent, *Voelcker*, 1691.
Butter changes colour naturally, *Voelcker*, 1692.
Going out; demand for highly-coloured butter declining; only saffron and annatto known, *Dunn*, 3030-31.
Matter behaving like methyl orange commonly used for low-class butters, *Brierley*, 3279.
Inferior butter made to look like good butter, *Brierley*, 3281.
Some unobjectionable, *Cassal*, 3838-41.
Not used by witness and not needed, *Carrington-Smith*, 4454-55, 4473, 4481-82.
Colour of butter affected by food and breed of cattle, *Carrington-Smith*, 4482-86.
Used, and colour affected by breed of cattle, *Long*, 4684.
Not fraudulent, *W. C. Williams*, 5353-57.
Much used in South England; some uncoloured in Midlands, *Hehner*, 5567.
Annatto in solution of cotton-seed oil, *Boseley*, 1050.
Not needed for New Zealand butter, *Cameron*, 6217-22.
Debatable point in Ireland. Witness holds it essential to meet varying local tastes, *Gibson*, 6364, 6369-70. Colour cannot be kept constant by food; it can by having Jersey cattle, 6366-68. Colouring enables margarine to be sold as butter, 6364, 6370.
Hardly ever used in creameries, *Lough*, 6648. Some dairies use annatto in very small quantities, 6649. Winter butter nearly same colour as summer butter, 6649-50, 6652, with mixed breeds of cattle, 6651; no Channel Islands cattle in question, 6652 An error in scalding may render annatto necessary, 6652. No great difficulty as to colour, 6653.
Uniformity of colour means artificial coloration, *Poore*, 7369.

97. COLOURING MATTERS—*continued.*

Butter : Nature :
- Danish colouring, *Shanahan*, 370-74.
- Annatto, dissolved in cotton-seed oil, by Aylesbury Dairy Co., *Boseley*, 1101.

Butter : Quantity :
- Small, *Shanahan*, 371-72.
- Standardising needed, *Richmond*, 5762.

Butter : Why used :
- To secure uniform colour, *Shanahan*, 369.

Carmine :
- Used in France for glacé and crystallised cherries, non-injurious, *Copeman*, 1178.

Cheese :
- Annatto used, largely, *Trengrouse*, 643-45.
- Used only to satisfy local public demands, *Lovell*, 734-37.
- Some markets will not take coloured cheese, *McCracken*, 2962.
- Everybody knows cheeses are coloured, *McCracken*, 2969.
- Colouring favoured by Staffordshire Chamber of Agriculture, *Carrington Smith*, 4488-4503.
- Used, for purposes of price, and to supply local demand, annatto being in question, *Carrington Smith*, 4457-62, 4477-80.
- Used in some, *Long*, 4684.
- Matter of public fancy, *Long*, 4687-88.
- Unnecessary, save to meet public demand, *Hudson*, 533.
- Some unobjectionable, *Cassal*, 3842-43.
- Has no opinion to offer as to the colouring of cheese, *Hattersley*, 5816-17.
- Annatto, exclusively, *Cameron*, 6222-25.

Cheese : Nature :
- Annatto said to be used to meet public demand, *Hudson*, 534-36.

Chlorophyll :
- Not a successful substitute for copper sulphate, *Copeman*, 1188.

Chromate of Lead :
- Used to be found in confectionery, *Hill*, 2485-86.
- Known to be used, *Fisher*, 4780.

Classification :
- Scheduled in Belgium, *Blyth*, 3399, 3400.
- Scheduling should, and could be made in this country, *Blyth*, 3404-6.
- Would have to be made on general principles, *Blyth*, 3411.

Cochineal :
- Used freely in jams, jellies, &c., *Copeman*, 1176.
- Non-injurious, *Copeman*, 1176.
- Used in preserved cherries, *Copeman*, 1178.

Cocoa :
- None found, *W. C. Williams*, 5379.

Coffee :
- None found, *W. C. Williams*, 5379.

Confectionery :
- Complete list, *Boseley*, 1049, 1064-70 (App. No 18).
- Hoffman's violet used for sweets, *Boseley*, 1139-40.
- Aniline dyes in sweets and popcorn, *Voelcker* 1666-69.
- Chromate of lead used to be found, *Hill*, 2485-86.
- Now harmless, *Hill*, 2487-88.
- Sweetmeats of red colour nearly always coloured with rhodamine or analogous colour, not a noxious substance, *Blyth*, 3369-70.
- Charcoal used for sweets, *Cassal*, 3847.
- Aniline dyes used, *Cassal*, 3847-48.
- In one sample of sweets, 0·34 per cent. of oxide of iron found, *Cassal*, 3847.

Confectionery : Quantities.
- Amounts used, *Boseley*, 1049, 1064-70 (App. No. 8, Table Q.).

97. COLOURING MATTERS—*continued.*

Dairy Products :
- Annatto chiefly, an extract from the plant *Bixa orellana*, *Boseley*, 1050; *McCracken*, 2956-57.
- Universal, but of limited variety, *McCracken*, 2954-55.
- Aniline dyes no doubt used, *McCracken*, 2958-59, 2976-77, 2981-82, 2985-90, 3000, 3001.
- Yellows used in harmless quantities, from continent, Germany, or Holland, *McCracken*, 2978-80, 2998-99.
- Aniline and annatto mixture used, *McCracken*, 2983-84.
- Uniform colour desired, *McCracken*, 2960.
- Colours not separated, *Blyth*, 3365-66.
- Opposed by Central Chamber of Agriculture by formal resolution, *Carrington Smith*, 4410-11, 4487.
- Known to be used by 64 out of 100 circularised farmers, *Carrington Smith*, 4474-76.
- Should be prohibited; but little hurt to trade would result, *Long*, 4685-86.

Declaration :
- Would not lead to consumption of fruit in natural state, *Copeman*, 1179-80.
- In food should be made, save as to cheese, *Cameron*, 2587-91.
- Would only harass trade; all trades should be treated alike, *McCracken*, 2966-72, 3004.
- Poisonous colours should be declared, *McCracken*, 2973-74.
- Nature and amount should be stated, *Blyth*, 3435-37; *Brunton*, 7470.
- Should be made; Crosse and Blackwell declare them in some cases, *Blackwell*, 4878, 4898; and also of nature, 4899; and amount, 4900.
- Might prevent fraud, *W. C. Williams*, 5350. Should be made as to cocoa nibs coloured by red oxides of iron, 5395-5400; and of copper in peas, 5401.
- Should designate poisonous colours as such, *Dupré*, 5921. This would go a long way, 5937.
- They should be declared in butter, *Poore*, 7368.
- All aniline dyes should be declared, 7398-99.

Digestion, Effects on :
- Reference given to experiments, *Boseley*, 1071-73.

France : Regulation :
- Strict, *Hudson*, 521-22.

Fraudulent :
- "Smokine" described, *Hope*, 6849. Use fraudulent, 6849-51. Glucose and treacle sold as syrup also fraudulent and burnt sugar and dilute acetic acid when sold as vinegar, 6851. Latter not injurious. Colouring matters conceal staleness, inferiority and dirt, 6852. Colourings of "egg-powders" fraudulent, 6863, 6866.

Harmless :
- Not objected to in butter, cheese, confectionery, and general fancy goods, *W. C. Williams*, 5350, 5385-87.
- Not objected to, *Dupré*, 5931, but proof of character should precede use, 5932.
- Sometimes ornamental and harmless, *Hope*, 6847-48.

Health :
- Should not be sacrificed to colouring matters, *Hill*, 2483.

Injurious :
- Should be scheduled for all produce, *Blyth*, 3360-61, 3371-75.
- Weyl holds picric acid, dinitrokresol, Martius' yellow, Bismarck brown, orange II., and metanil brown, to be injurious, *Blyth*, 3358.
- Injurious properties could be determined by long experimentation on animals, by multiple persons, *Blyth*, 3398, 3412.
- Salts of copper, picric acid, and impure aniline dyes occasionally used, *Blyth*, 3417, 18.

97. COLOURING MATTERS—*continued.*

INJURIOUS—*continued.*
Dinitrokresol would presumably derange a child's digestive organs, *Blyth*, 3420.
Not met with now, but Dr. Campbell Brown has found lead chromate in sugar oranges and lemons, *W. C. Williams*, 5387-90.
Not come across, *Attfield*, 6570-71. Common knowledge that some harmful substances are used, 6572.

IRON SALTS:
Not well known, *Boseley*, 1107-11, 1118-27.

JAMS:
Complete list, *Boseley*, 1049, 1064-70 (App. No. 18).
In dark coloured jams, majenta, or fuchsine, *Boseley*, 1063, 1148-51.
Apricot, yellow jams, and marmalade seldom coloured, *Boseley*, 1063.
Not requisite, *Boseley*, 1080.
Improve appearance, *Boseley*, 1081.
None used by Messrs. Keiller, *Boseley*, 1142-43.
Used, *Copeman*, 1231.
Heard of, as found, *Voelcker*, 1666-69.
By cochineal extract, only colouring known, *Blackwell*, 4879, in small quantity and harmless, giving uniformity of colour, 4880-83. Public demand a pleasing looking article without question of process adopted, 4891, being quite indifferent thereto, 4891-95.
Unknown red dye found, *W. C. Williams*, 5361.

JAMS: Quantity:
Amounts used, *Boseley*, 1049, 1064-70 (App. No. 8, Table Q.).

JELLIES:
Coloured with small quantities of colouring, chiefly yellows and reds, *Fisher*, 4793-94.

MAGENTA:
Health of workers not affected, *Boseley*, 1074, 1145-47, 1164.
Never tested, *Boseley*, 1152-58.

MARGARINE:
Usually fraudulent, *Voelcker*, 1692; *Cassal*, 3838-41.
To meet demand and resemble butter, *McCracken*, 2963-65; *Brierley*, 3280,
Matter behaving like methyl orange commonly used for margarine, *Brierley*, 3279.
By the trade neither honest nor desirable, *Hattersley*, 5806-13; does not hurt the Aylesbury Dairy Company's butter trade, 5814.

MARTIUS' YELLOW:
Rarely used, *Boseley*, 1112-14.
Poisonous, *Boseley*, 1115.
Never known in butter, *Boseley*, 1116.
Used in small quantity in macaroni, *Blyth*, 3358, 3362-64.
Never detected, *Hehner*, 5571.

MEAT:
Red dyes found, *W. C. Williams*, 5362-66, 5370, 5377-78.

MEAT EXTRACTS:
Red ochre used in bloater pastes, and German sausage skins sometimes dyed, *Fisher*, 4771, 4775-71.
Nitrites not poisonous as used for meats, *Fisher*, 4771.

METALLIC:
None used by Messrs. Keiller, *Boseley*, 1074.
No arsenic or lead in those used by Messrs. Keiller, *Boseley*, 1074.

MILK:
Annatto, in aqueous solution, $\frac{1}{300000}$, *Boseley*, 1050.
Annatto as used quite insufficient to flavour milk, *Boseley*, 1051.
Aniline dyes becoming more general, *Boseley*, 1098-1100.
No excuse for *Voelcker*, 1691, 1748.

97. COLOURING MATTERS—*continued.*

MILK—*continued.*
Aniline colours used at times, *Hill*, 2485-86.
Annatto and possibly turmeric used, *Hill*, 2485-86.
Now harmless, *Hill*, 2487-91.
Not known in Southampton, annatto freely used years ago, and no bad results heard of, *Brierley*, 3282-86.
Fraudulent, *Cassal*, 3842-43.
Aniline dye used, *Cassal*, 3844.
Might be an offence, as fraudulent, *W. C. Williams*, 5351-52, 5420-21.
London milk almost invariably coloured, *Hehner*, 5572-75, deceptive, but universal, practice, 5573.
Do not rise in the cream, but remain in the skim milk, *Richmond*, 5862-63.
Complaints have been made of milk of excellent quality because uncoloured, *Richmond*, 5870-71.
Colouring matter used by Aylesbury Dairy Co., to secure continuity of colour all the year round, *Hattersley*, 5802, 5804-5. Would be glad to be able to do without it, 5802, in milk, 5815. Customers demand coloured milk, but little colour used in summer, 5803, and will have it, 5857-60. Repeated attempts to do without colouring milk have failed, 1861. Complaints have followed its temporary disuse, 5866-69.
There is annatto in most milk, *Sorensen*, 7083.
Colouring of milk caused dyspepsia in an infant, *Halliburton*, 7538.

OXIDE OF IRON:
Found in cocoa, *Boseley*, 1130-37.
May have been added to cocoa as an ochre, *Boseley*, 1138.
Found in a sample of sweets, *Cassal*, 4847.
Known to be used, *Fisher*, 4780.

PEPPER:
Used, doubtless harmless, *W. C. Williams*, 5247-49.

PHYSIOLOGICAL EFFECTS:
Aniline yellow and methyl orange produce undesirable symptoms, *Long*, 4684.

PICKLES:
Red cabbage, 4 ozs. sulphuric acid to 40 gallon barrel, *Boseley*, 1056-60.
Piccalilli, 3 lbs. turmeric to 40 gallon barrel, *Boseley*, 1056-60.
Not coloured, *Hill*, 2484; for many years, *Blackwell*, 4885.
Derivatives never found, *Richmond*, 5765.

POISONING:
Case by dinitrokresol recorded by Weyl, *Blyth*, 3360, 3396-97.
Iron and oxide of iron not usually classed as poison and poisonous salts, *W. C. Williams*, 5394.
Colouring matters of a poisonous nature should not be employed, *Dupré*, 5913, in any quantity, 5914. Colours should be classified, 5918, and poisonous colours entirely prohibited, 5919.

PRESERVATIVES:
Some meat preservatives coloured, *Fisher*, 4772-74.

PROCEEDINGS:
No experience as to legal dealings with injurious colourings, *Hill*, 2494-95.

PROHIBITION:
In milk urged, *Voelcker*, 1691, 1748; *Cameron* 2592.
Not advocated in butter, *Voelcker*, 1691 *Cameron*, 2594-95.
Specified metallic colourings prohibited in certain countries, as Belgium and France, and should be at home, *Hill*, 2496-98.
Would close some markets to Scotland for cheese, *McCracken*, 2961.
Needed as regards certain coal tar derivatives, *Brierley*, 3290-94.

97. COLOURING MATTERS—*continued.*

PROHIBITION—*continued.*
Weyl advised in Germany as to certain colours, *Blyth*, 3358; and certain colours, including picric acid believed to be prohibited there, 3359.
Should be absolute as to injurious matters, *e.g.*, sulphate of copper in vegetables, ferruginous earthy matters, oxide of iron, and inferior aniline dyes in sweets, *Cassal*, 3844-46.
Desired as to dairy produce by Central and Associated Chambers of Agriculture, *Carrington Smith*, 4487, 4554-57.
Desired by Staffordshire Chamber of Agriculture as to milk and margarine as being fraudulent, *Carrington Smith*, 4488-4503.
Might temporarily restrict milk supply, and raise prices for a short time, *Carrington Smith*, 4413-14, 4549.
Should be effected in dairy produce, *Long*, 4685-86.
Colouring of milk should not be allowed, *Long*, 4961, 4968, because fraudulent, 4962. Not believed in for butter, 4963, nor for cheese, 4964-67. Should not be allowed in cream, 4968, or butter, or margarine unless it be very distinctively tinted, 4969, to prevent fraud, 4970.
Of fraudulent colouring as of "mixtures" and the like, advocated, *Dupré*, 5938-41.
Prohibition of colouring of butter would lead to seasonal changes in natural colour and give dissatisfaction, *Gibson*, 6365.
Colouring matters should not be used; such use is provocative of danger, *Poore*, 7368.
Better to avoid artificial dyes, *Halliburton*, 7539; public taste known to be arbitrary, 7540.

RESTRICTION:
Control a difficult problem, scheduling might be adopted, *W. C. Williams*, 5384-85.

SAFFRON:
Used, and non-injurious, *Copeman*, 1178.

SAUSAGES:
Colouring used, including rose pink, *Tubb-Thomas*, 4973.
Red dyes found, *W. C. Williams*, 5362-66 5370, 5377-78.
Commonest used described, *Hope*, 6647-48.

SPICES:
Used, doubtless harmless, *W. C. Williams*, 5347-49.

SUGAR:
Imitation Demerara occasionally treated with aniline dyes, *Boseley*, 1117; *Hill*, 2485-86.
Sometimes fraudulently coloured, *Cassal*, 3844, 3850.
Aniline dyes used, *Cassal*, 3847-48.
Caramel only should be present; and it does not dye, *Cassal*, 3849-50.

SULPHUR:
Used for bleaching raisins, apricots, plums, &c., *Copeman*, 1172.
Keeps fruit a good colour, and sometimes used for flavouring it, *Copeman*, 1173.
Not known to be harmful as used, *Copeman* 1173.
Added to bloom of Carlsbad plums, *Copeman* 1174-76.
Small amount used in champignons, *Copema* 1174-76.
Coloured goods generally preferred and demanded, *Copeman*, 1280-81.

SULPHURIC ACID:
Not known in jams and preserved fru, *Copeman*, 1177.

TEA:
None found, *W. C. Williams*, 5379.

TURMERIC:
Used in piccalilli, &c., and non-injurious, *Copeman*, 1178.

VEGETABLES:
Such vegetables fairly well used *Copeman*, 1181-82.

97. COLOURING MATTERS—*continued.*

VEGETABLES—*continued.*
Mostly free, *Hill*, 2481-82.
Those not coppered less green, *Hill*, 2483.
Bright green, found to contain aniline dye, *Blyth*, 3356.

WINE:
Grape juice sufficiently colours, *Blyth*, 3354.
Not coloured on any scale; one sample of Burgundy contained colouring like fuchsine, *Blyth*, 3413-15.
Liqueurs not examined, *Blyth*, 3416.
Colouring matters, other than grape juice, not needed in wine, *Gilbey*, 4361. "Colour wine" used, but little colouring matter, 4387, 4393. Alum not known, 4388. Probably burnt sugar and glucose in liqueurs, 4389. Salts of copper, picric acid, or cochineal not known, 4390-91. No excuse or need for colourings even in cheap wines, 4394-95. Messrs. Gilbey's wines tested for colouring matters, 4396-4403 and footnote.

ZINC COMPOUNDS:
Believed to be added to peas, *Boseley*, 1128-29.

98. COPPER IN FOODS:

Copper in foods not natural to peas, *Copeman*, 1220.
Present naturally in beans, *Copeman*, 1220.
No ill-results known, *Brierley*, 3289.
Found in peas, flour, bread, tobacco, and ash of lime trees, *Blyth*, 3377.
Held to be natural to peas, *Blyth*, 3391-95.
French preserved beans supposed to be coppered, *Blackwell*, 4876.
Found only in very minute amounts in vegetables and jams as regards a particular firm, and inference drawn of accidental admixture by method of manufacture, *Attfield*, 6573.
Copper accidentally in canned foods, apart from its use as a colouring agent, *Halliburton*, 7534-38.

POISONOUS PROPERTIES:
Wrong to use a strong poison to simply colour food, *Blyth*, 3434.

PROHIBITION:
In Germany, *Copeman*, 1233.
Should be entire, *Cameron*, 2557.

USES:
For greengages in France, *Copeman*, 1178.
To preserve colour of peas, *Vasey*, 2016.

FOREIGN LAW AND PRACTICE: France:
No restriction as to peas, *Copeman*, 1193-94 (App. No. 21).

Germany:
Copper sulphate in peas held in Germany to be harmless in amount required, *Grünbaum*, 6448-49; and not prohibited in minute quantities, 6450-51. Laws of other countries not known, 6452-56.

Italy:
Quantity used in peas, in parts of country, $\frac{1}{10000}$, *Copeman*, 1191.

Switzerland:
Quantity used in peas, in parts of country, $\frac{1}{10000}$, *Copeman*, 1191.

MEDICINAL USE:
Doses, *Copeman*, 1260, 1299, 1302.
Pharmacopœial dose of sulphate of copper from ½ to 10 grains, *Blyth*, 3430-31.

PEAS:
Subject not well known, *Boseley*, 1107-11, 1118-27.
Uneatable if strongly coppered, *Copeman*, 1260-66, 1296.

PEAS: Analyses:
Made in France, *Copeman*, 1215, 1217-18
Quantitative, not trusted, *Copeman*, 1256-5
Of whole lb., desirable, *Vasey*, 2006.
Show copper as an organic salt of copper, *Cameron*, 2552.
Method of detection at fault, *Blyth*, 3378-91.
About 2½ oz. examined, from well-shaken sample, *W. C. Williams*, 5341-42.

98. COPPER IN FOODS—*continued.*

- Peas : Colour :
  - Fairly bright green, *Copeman*, 1290.
  - Not known to go off, *Copeman*, 1296.
  - Preserved as natural, but old peas not used, *Bannister*, 3561-69.
  - Recovered, *Bannister*, 3570.
  - Colouring not fraudulent, *Bannister*, 3571-72, 3575-80.
- Peas : Complaints :
  - Unknown from London clubs, &c., *Copeman*, 1292.
- Peas : Declaration, Simple :
  - Labelling alone required in certain American cities, *Copeman*, 1191.
  - Labelling alone requisite, *Copeman*, 1222.
  - Labelling not necessary in many cases, *Copeman*, 1229.
  - Sufficient, *Vasey*, 2026-27.
  - Would seldom meet consumer's eye, *Bannister*, 3592-93.
  - No objection to, *Bannister*, 3592, 3594, 3596.
  - Made in Pennsylvania, *Bannister*, 3595.
  - Should be made, *W. C. Williams*, 5401.
- Peas : Declaration, Quantity :
  - Actual amount, known to be stated in America, *Copeman*, 1222.
  - No objection, *Copeman*, 1223-28, 1303-4; *Vasey*, 2094-96; *Bannister*, 3597.
  - Difficult, *Blyth*, 3436-37.
  - Should be specific, *Poore*, 7407-11; *Brunton* 7469.
- Peas : Demand :
  - Public will have green peas, *Copeman*, 1283 84, 1286-88; *Bannister*, 3573-74.
  - In every restaurant in Ostend, and in common use in Belgium, *Copeman*, 1289.
  - Would not habitually eat coppered peas, and would warn patients against them, *Cameron*, 2599.
  - People would avoid knowingly eating them, *McCracken*, 2975.
  - Command a large sale, *Bannister*, 3560.
- Peas : Distribution :
  - Not always even, *Copeman*, 1258.
  - Unknown, *Vasey*, 2014; *Bannister*, 3599-3600.
  - Likely to be mostly outside, *Vasey*, 2015.
  - Absolute uniformity not expected, thoug found, *Vasey*, 2019, 2024-25, 2028-29.
  - Probably general, and by some deemed to be associated with chlorophyll of pea, tending to its concentration outside the pea, *Bannister*, 3600-5.
  - Method of adding not known, *Blackwell*, 4896.
  - Found in interior of peas, *W. C. Williams*, 5343.
  - Unequal distribution in peas should hold manufacturer liable if fixed amount for whole be exceeded in any one portion, *Brunton*, 7471-72.
- Peas : Keeping Quality :
  - Unknown with 1½ grains of copper sulphate per lb. of peas, *Copeman*, 1268-69, 1272.
  - No objection to experiments being made, *Copeman*, 1270.
- Peas : General Physiological Effects :
  - Of 6 grains per lb., unknown, *Vasey*, 2008.
  - Must determine its use, *Vasey*, 2018.
  - Copper not a constituent of the body, *Mann*, 2621.
  - Solubility in human economy or gastric juice doubted, *Blyth*, 3428.
  - Copper albuminate not dissolved during digestion, *Bannister*, 3581-86.
  - Not known, *Bannister*, 3606-7, 3614-18.
  - Copper sulphate used as an astringent in doses under one grain, *Bannister*, 3613.
  - Effects of copper, in unsatisfactory position, *Fisher*, 4781-82.
  - About 40 per cent. of copper in peas enters the stomach in a soluble form, *W. C. Williams*, 5372-76.
  - Effect of 1 grain per lb. of peas unknown. Some people idiosyncratic to minute quantities, *Dupré*, 5922-25; and idiosyncrasy is very common 5926-30.

98. COPPER IN FOODS—*continued.*

- Peas : General Physiological Effects.
  - Copper as found in peas held to be soluble in human economy, *Hope*, 6930; on eminent hearsay evidence, 6931. Uneasiness and indigestion have resulted from coppered peas, 6932.
  - Copper sulphate in peas will probably enter into combination with proteid constituents. Action of copper is very largely on the intestines, *Starling*, 6981-82. Is opposed to small amounts of copper for colouring peas, 6983. Would be dangerous taken constantly in ½ grain to lb. of peas, 6984-85.
  - Held to be soluble in the human body, *Poore*, 7400-2.
  - Harmfulness of copper in peas depends on quantity used, *Halliburton*, 7554.
- Peas : Affirmed Physiological Effect :
  - Dangerous to add 7½ grains of metallic copper per lb., *Vasey*, 2093.
  - Copper in any quantity likely to be highly deleterious, *Womack*, 7510-12.
- Peas : Negative Physiological Effects :
  - No case of poisoning known, *Copeman*, 1197, 1201-3, 1263, 1274, 1297-98 (App. No. 22).
  - Illness unknown, *Copeman*, 1198.
  - Experiments made lead to inference that the digestive system may dissolve the copper, but Professor Fraser's experiments differ, *Cameron*, 2549-51.
  - No ill-results known, *Brierley*, 3288; *Bannister*, 3587-89, 3608-11.
  - A certain undefined amount would not be injurious, *Blyth*, 3421-22.
  - No physiological result anticipated from 5 grains per lb. of peas, *Blyth*, 3426-27, 3429, 3433.
  - No injury to health from ¼ grain per lb., *W. C. Williams*, 5417.
  - Copper in minute doses quite innocuous, *Brunton*, 7468.
- Poisonous Quality :
  - Proof difficult, *Copeman*, 1264.
  - Not very strong, *Copeman*, 1259.
  - Copper a poison, to some extent cumulative, but not quite like lead, *Cameron*, 2533, 2553-54, 2556, 2600.
  - A slow poison, with delayed results never definitely traced, *Cameron*, 2553.
  - No cases of poisoning known, *Cameron*, 2556.
  - Copper produces chronic poisoning, *Mann*, 2621.
  - Occasional doses could not be proved harmful, *Mann*, 2622.
  - In large quantities, but not known to be cumulative, *Bannister*, 3590-91.
  - Copper sulphate a known poison, *Cassal*, 3846.
  - Copper is injurious to health, and along with its salts is poisonous, *W. C. Williams*, 5393.
  - Copper in peas a poison, perhaps not injurious in quantities used, but use fraudulent, and should be prohibited, *Hehner*, 5628; limit of safety not so easily overstepped as with some poisons, 5629; but copper sulphate has a point where it becomes distinctly poisonous, 5630.
- Proceedings :
  - Medical evidence in litigation cases considered important, *Copeman*, 1305-6.
  - Taken in Southampton years ago, *Brierley*, 3287.
  - None taken in Birmingham, *Hill*, 2492-93.
- Prohibition :
  - Would ruin the trade, *Copeman*, 1285.
  - Was in France, but withdrawn, *Vasey*, 2088-89.
  - Should be effected, *Mann*, 2621; *Cassal*, 3844-46; *Stevenson*, 4841; *Hehner*, 5628; *Dupré*, 5915, 5917.
  - Not necessary, as used in France, *Bannister*, 3560.
  - Prohibition of copper in peas desired, *W. C. Williams*, 5358, 5416; and if not so, should be strictly limited, 5359. Peas probably unsaleable if not greened, 5360, 5368.
  - Copper in peas indefensible, *Poore*, 7370; in any quantity, 7371-72, 7403-4.

98. COPPER IN FOODS—*continued.*

Prohibition—*continued.*
- Copper in peas to be condemned, *Halliburton*, 7555, 7557; as a foreign substance, and cumulative; no copper normally in the human body, 7556. But no experiments made by witness, 7595-96. Cumulative effects likely to become increasingly harmful, 7597-7600.

Quantity found:
- Of metallic copper in France, *Copeman*, 1209-14 (App. No. 20).
- Larger than in other vegetables, *Copeman*, 1219-21.
- Six grains per lb., *Vasey*, 2005, 2007, 2097.
- Difficulty of defining, *Vasey*, 2019-21.
- Some 4 to 5 grains per lb., *Blyth*, 3423-25.
- Diminishing, *Stevenson*, 4840; *W. C. Williams*, 5337-40, 5344-46.
- Has found $\frac{1}{4}$ grain per lb. in peas quite green. Interior of peas found to contain copper, *W. C. Williams*, 5343.

Quantity, Maximum:
- Fixation advocated, *Copeman*, 1199, 1200, 1206-8, 1285.
- Desired, about 2·7 grains of copper sulphate per lb., *Copeman*, 1215-16.
- Above amount used in Kent, *Copeman*, 1266.
- Should be determined, *Vasey*, 2022-23.
- Too much would spoil the peas, *Bannister*, 3597.
- Most found, $\frac{1}{10000}$, and $\frac{1}{7700}$ regarded as a fair average by French Government, *Bannister*, 3598.
- About $\frac{1}{10000}$, or 2·9 grains of commercial copper sulphate per lb. of peas would be safe, *Bannister*, 3612.

Quantity, Minimum:
- Requisite, about two grains per lb., *Copeman*, 1240-43, 1253-56.
- Minute quantity suffices, *W. C. Williams*, 5369, 5380-83.
- Copper not uncommon in bottled peas, fruits, and vegetables; $\frac{1}{2}$ grain to a lb. deemed by trade necessary to green the peas, *Hope*, 6929.

RESTRICTION:
- None in France, *Copeman*, 1193-94 (App. No. 21).
- To one grain per lb. would be impracticable, *Copeman*, 1267.

98. COPPER IN FOODS—*continued.*

RESTRICTION—*continued.*
- Foreign laws have changed, *Copeman*, 1249-52, 1271.
- Use requires very strict control, *W. C. Williams*, 5337-40, 5344-46.

USE:
- To preserve colour, *Vasey*, 2016; *W. C. Williams*, 5402.
- Not universal, *Vasey*, 2017, 2030-35.
- Frequently found, *Cameron*, 2527.
- Probably for greening, *Fisher*, 4783-85.
- Objectionable on ground of health, *Fisher*, 4787.
- Fraudulent, *Fisher*, 4788-92; *W. C. Williams*, 5403-15, 5420-27; *Poore*, 7405-6.
- Supposed to be used in foreign preserved peas. Crosse & Blackwell have sold uncoloured peas; not large trade; no demand here; large export trade, *Blackwell*, 4876-77.
- French peas coppered abroad, *Blackwell*, 4901.
- Ceased some years back, in force again, to meet public demand, *Dupré*, 5916.
- Scarcely fraudulent, *Dupré*, 5933-36.

COPPER SULPHATE:
- An injurious colouring agent, *Hill*, 2484.
- Not present as such in peas, *Vasey*, 2009-13, 2086-87; *Bannister*, 3619-25.

COPPER SULPHATE: Uses:
- For peas, beans, spinach, and mixed vegetables, *Copeman*, 1183.
- Above goods unsaleable unless greened, *Copeman*, 1184-87.
- Copper in peas not present as a sulphate, but as an insoluble proteid compound, possibly soluble at times, *Vasey*, 2009-13, 2086-87.

COPPER SULPHATE IN PEAS: Quantity used:
- From 2 to 2·8 grains per lb., *Copeman*, 1190.
- In parts of Switzerland and Italy, $\frac{1}{10000}$ *Copeman*, 1191.

COPPERED VEGETABLES:
- Copper found in many, and in all of French origin, *Blyth*, 3357, 3376.
- Copper a natural constituent, though fact disputed by a French chemist, *Blyth*, 3357, 3376, 3387-91.
- Foreign preserved vegetables supposed to be coppered, *Blackwell*, 4876.

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